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Yamada et al.

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(54) **EXTERNAL UNIT FOR INHALATION COMPONENT GENERATION DEVICE, INHALATION COMPONENT GENERATION SYSTEM, METHOD FOR CONTROLLING EXTERNAL UNIT FOR INHALATION COMPONENT GENERATION DEVICE, AND NON-TRANSITORY COMPUTER READABLE MEDIUM**

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(52) **U.S. Cl.**
CPC ***A24F 40/50*** (2020.01); ***A24F 40/51*** (2020.01); ***A24F 40/60*** (2020.01); ***A24F 40/90*** (2020.01);
(Continued)

(58) **Field of Classification Search**
CPC A24F 40/50; A24F 40/90; A24F 40/51; A24F 40/60; A24F 40/10; H02J 7/0042; H02J 7/007
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

8,093,859 B2 1/2012 Aradachi et al.
9,502,917 B2 11/2016 Xiang
(Continued)

FOREIGN PATENT DOCUMENTS

EP 0 750 385 A2 12/1996
EP 2 701 268 A1 2/2014
(Continued)

OTHER PUBLICATIONS

US Office Action issued Aug. 21, 2023, in corresponding U.S. Appl. No. 16/941,620, 31pp.
(Continued)

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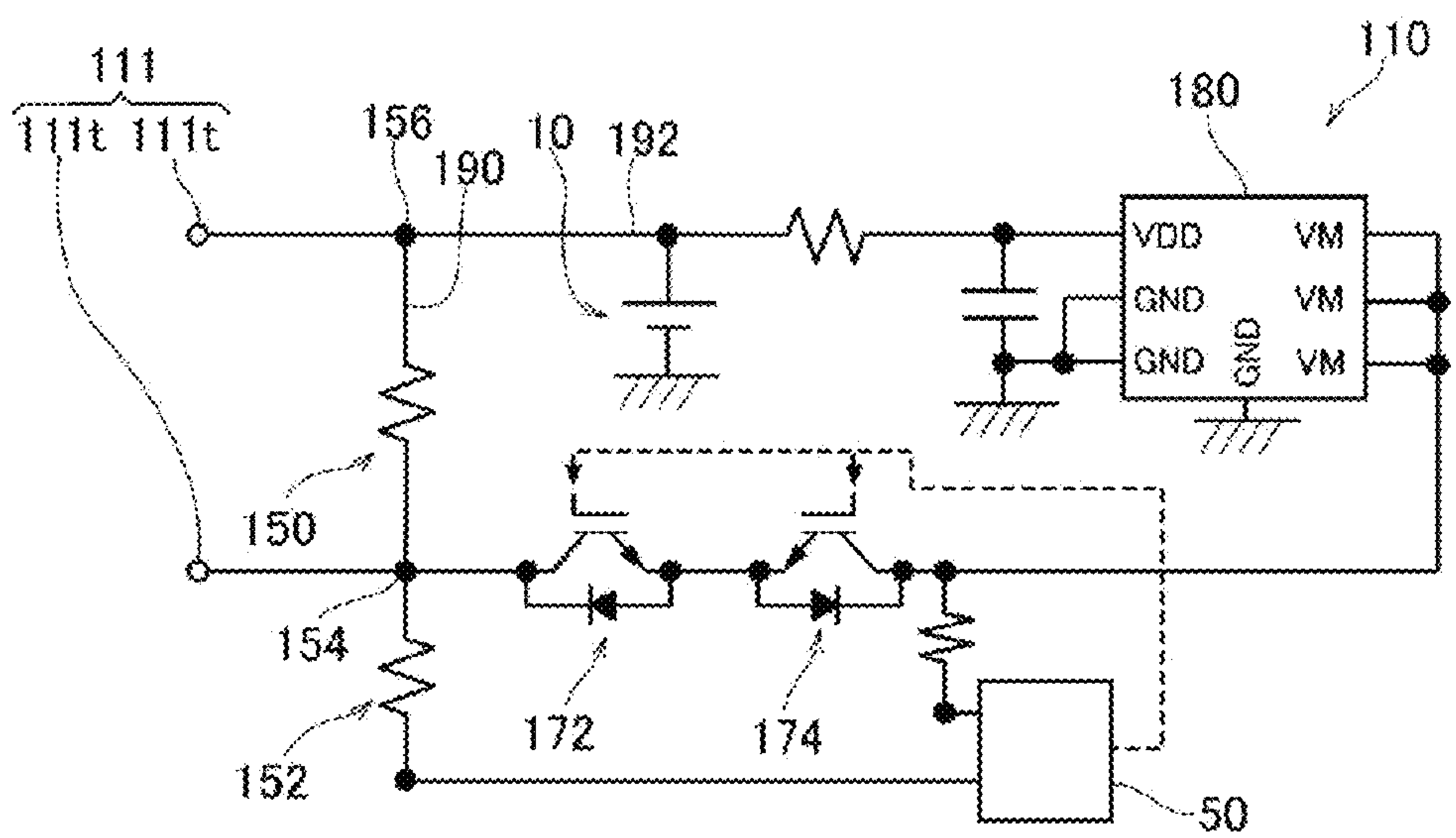
(57) **ABSTRACT**

An external unit for an inhalation component generation device includes a connection part that is electrically connectable to a power supply of the inhalation component generation device, a sensor that is capable of outputting an output value related to an electrical resistance value of a resistor provided in the power supply, and a first control part that is configured to determine, based on the output value, whether to change a predetermined control with respect to the power supply connected to the connection part or whether to perform the predetermined control.

16 Claims, 11 Drawing Sheets



(51) **Int. Cl.**

A24F 40/60	(2020.01)
A24F 40/90	(2020.01)
H02J 7/00	(2006.01)
A24F 40/10	(2020.01)

(52) **U.S. Cl.**
CPC ***H02J 7/0042*** (2013.01); ***H02J 7/007*** (2013.01); *A24F 40/10* (2020.01)

(56) **References Cited**

U.S. PATENT DOCUMENTS

2004/0160210	A1	8/2004	Bohne et al.	
2006/0152191	A1	7/2006	Lee et al.	
2008/0238361	A1	10/2008	Pinnell et al.	
2010/0308775	A1	12/2010	Mizutani et al.	
2014/0270727	A1*	9/2014	Ampolini	A24F 40/50 392/394
2015/0027472	A1	1/2015	Amir	
2015/0181942	A1	7/2015	Holzherr et al.	
2015/0189917	A1	7/2015	Xiang	
2015/0357837	A1	12/2015	Takai et al.	
2016/0057811	A1*	2/2016	Alarcon	A24F 40/50 219/494
2016/0242466	A1	8/2016	Lord et al.	
2016/0345627	A1	12/2016	Liu	
2017/0229885	A1	8/2017	Bernauer	

FOREIGN PATENT DOCUMENTS

EP	2 899 842	A1	7/2015
JP	08-304518	A	11/1996
JP	2012-234722	A	11/2012
JP	5151506	B2	2/2013
JP	5193619	B2	5/2013
JP	2014-143901	A	8/2014
JP	2015-049935	A	3/2015
JP	2015-534458	A	12/2015
JP	2016-533712	A	11/2016
WO	2007/041866	A1	4/2007
WO	2015/175700	A1	11/2015
WO	2016/119626	A1	8/2016

OTHER PUBLICATIONS

Communication pursuant to Article 94(3) EPC, issued Dec. 14, 2021, in corresponding European Patent Application No. 18 903 879.7, 5 pages.

Office Action issued on Dec. 5, 2022, in corresponding Chinese patent Application No. 201880088194.1, 31 pages.

Extended European Search Report issued Jan. 19, 2021, in corresponding European Patent Application No. 18903879.7.

Communication pursuant to Article 94(3) EPC issued Sep. 2, 2022, in corresponding European Patent Application No. 18 903 879.7.

International Search Report and Written Opinion mailed on May 1, 2018 for PCT/JP2018/003553 filed on Feb. 2, 2018, 13 pages including English Translation of the International Search Report.

International Search Report and Written Opinion mailed on May 1, 2018 for PCT/JP2018/003551 filed on Feb. 2, 2018, 10 pages including English Translation of the International Search Report.

Russian Office Action with Search Report issued on Feb. 12, 2021, against the corresponding Russian Patent Application No. 2020128834 and an English translation thereof.

* cited by examiner

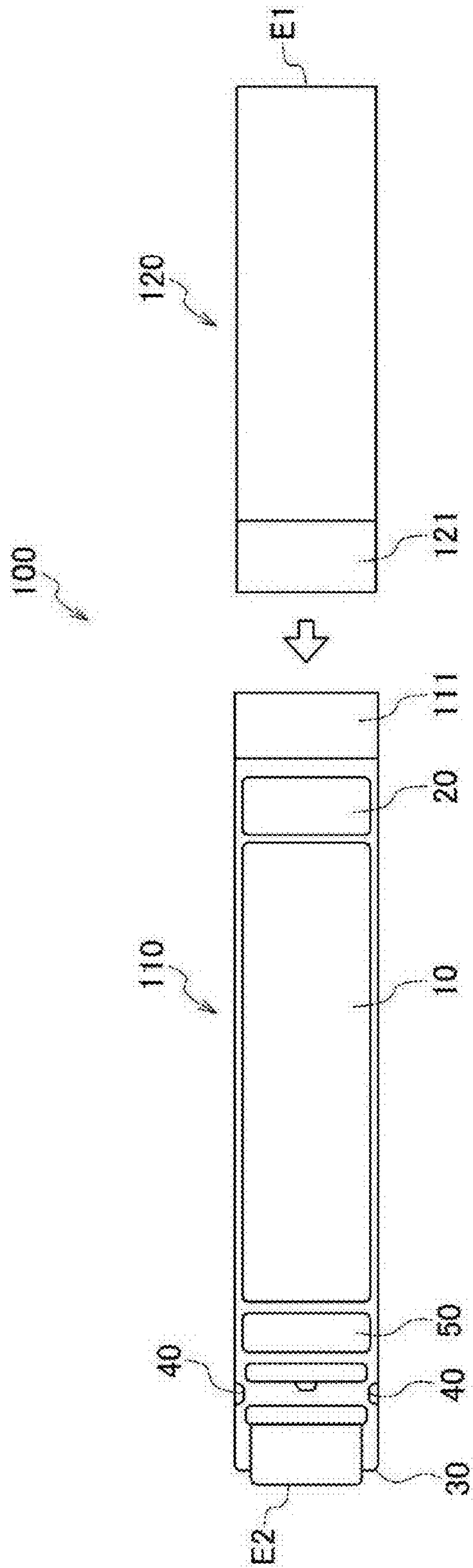


Fig. 1

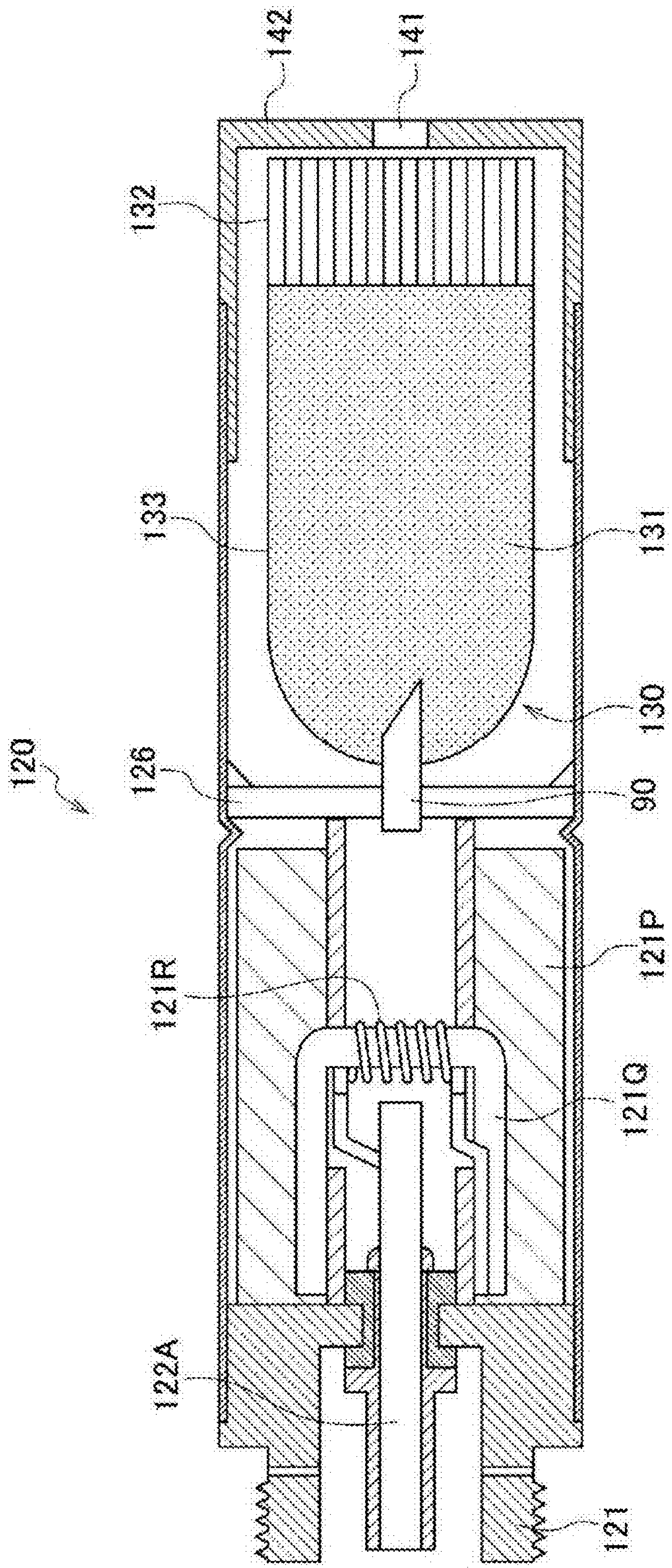
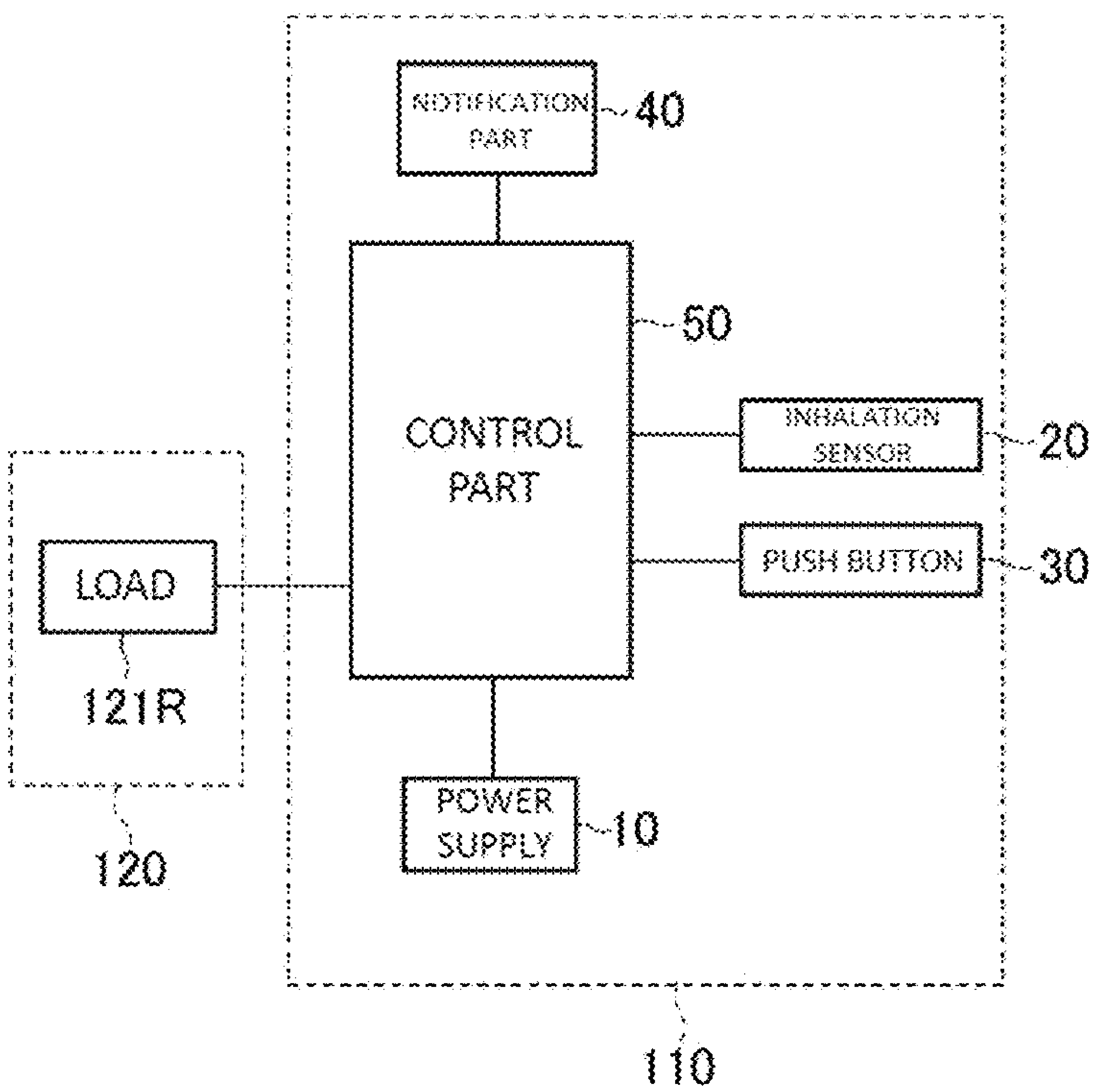


Fig. 2

Fig. 3


NOTIFICATION PART
40
CONTROL PART
50
INHALATION SENSOR
20
PUSH BUTTON
30
LOAD
121R
120
POWER SUPPLY
10
110

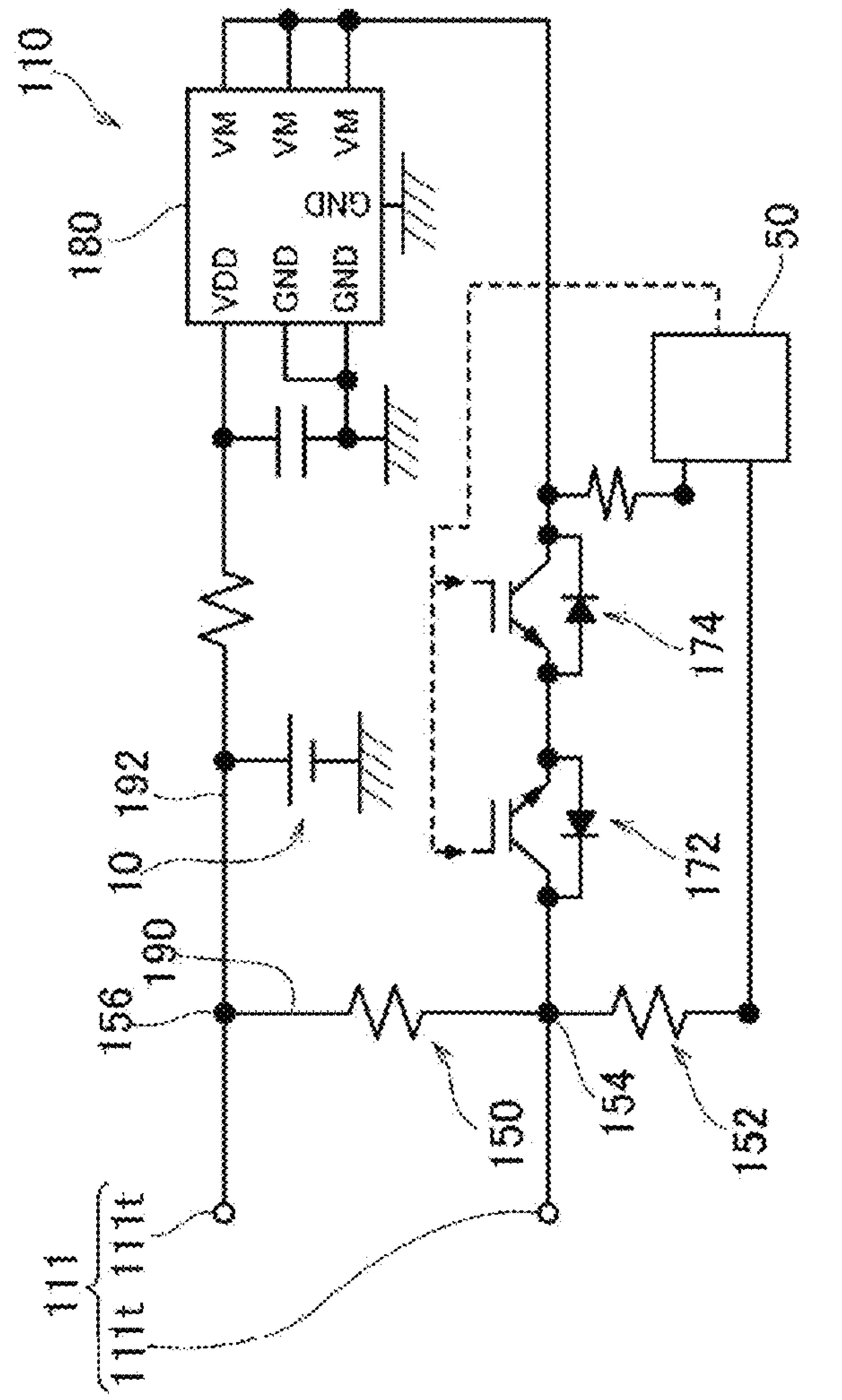

110
180
VDD
GND
GND
GND
VM
VM
VM
50
174
172
192
10
190
156
150
154
152
111
111t
111t

Fig. 4

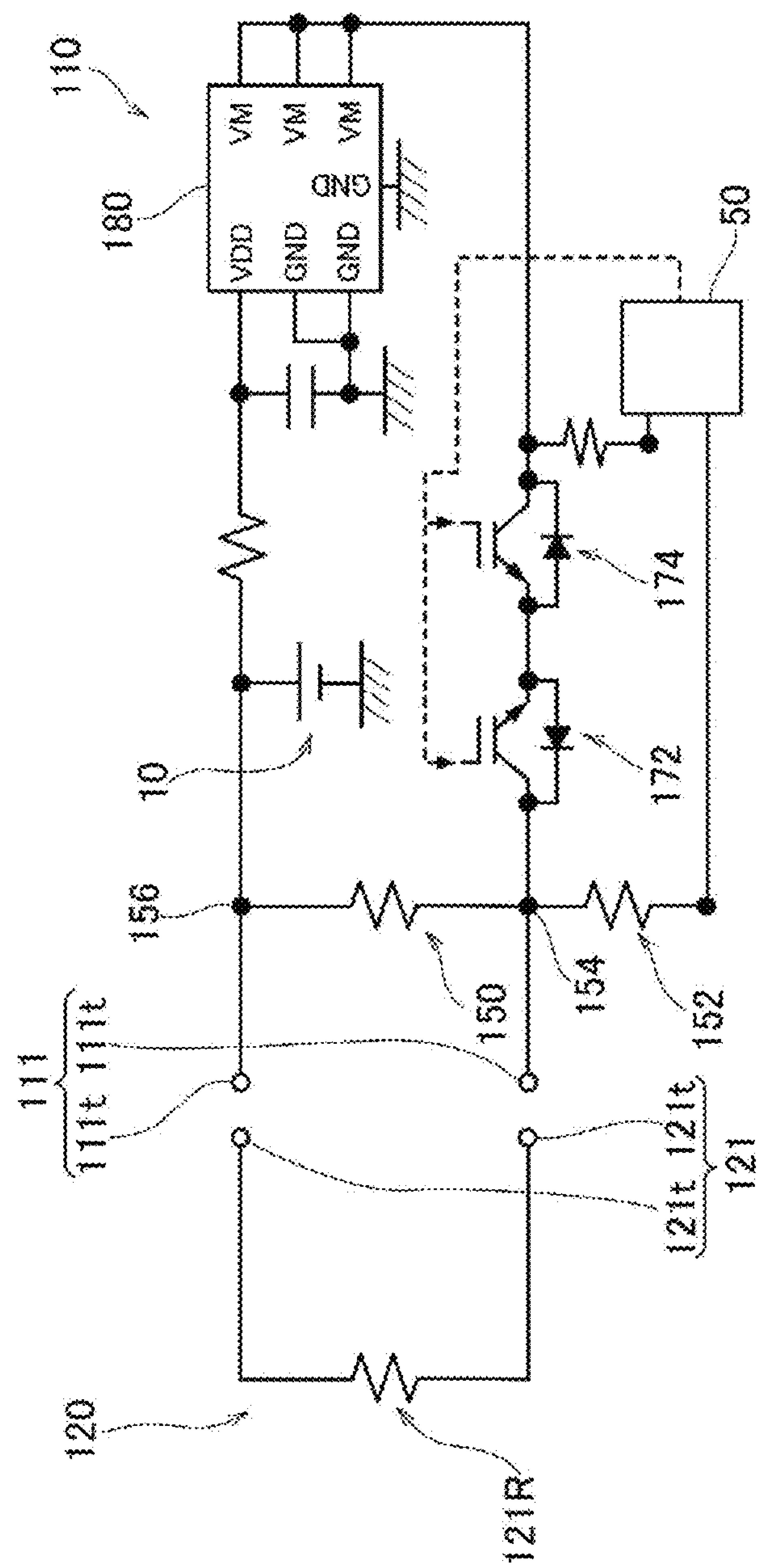
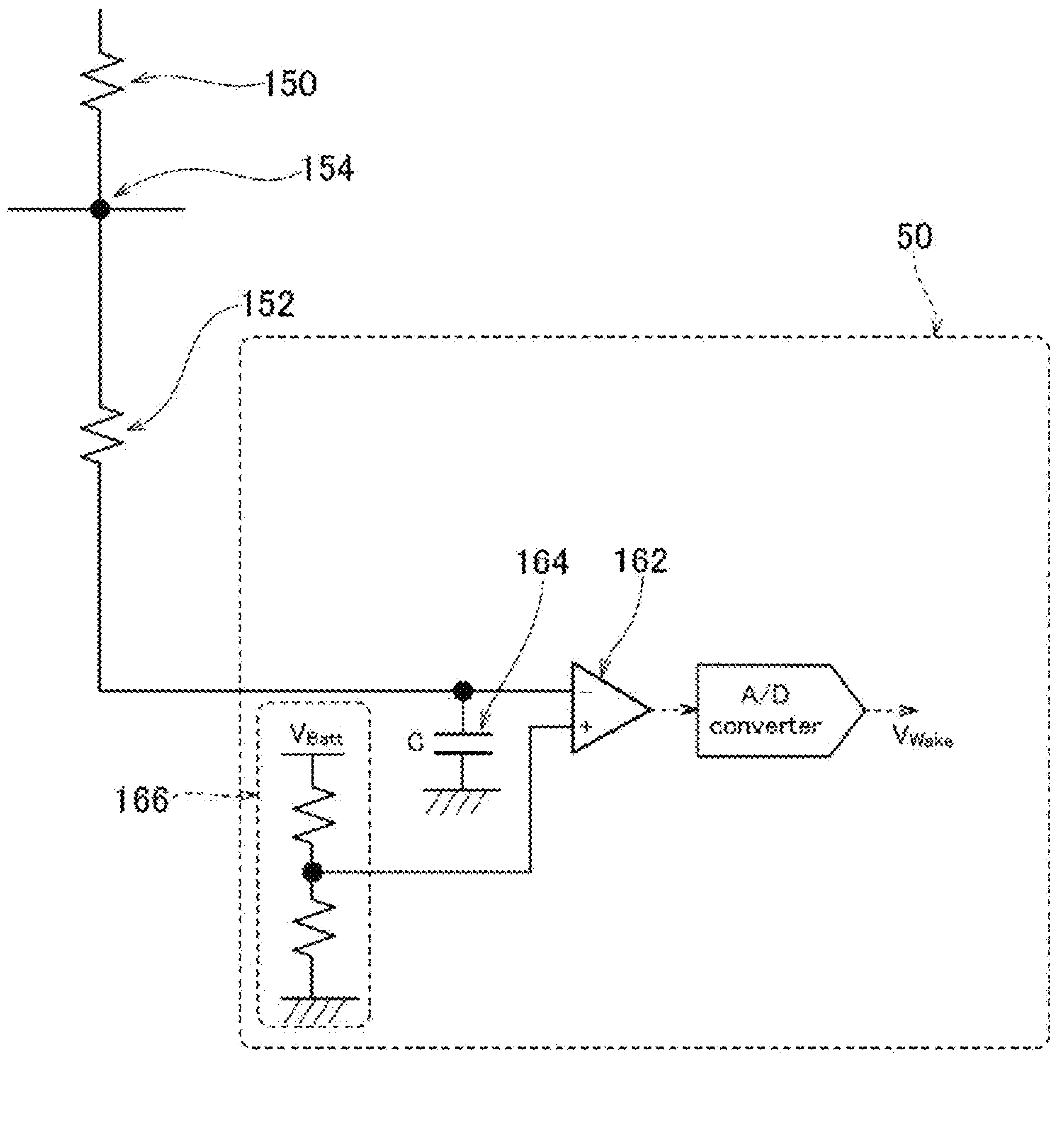

110
180
VDD
GND
GND
VM
VM
VM
GND
50
174
172
10
156
150
154
152
111
111t 111t
121
121t 121t
120
121R

Fig. 5

Fig. 6



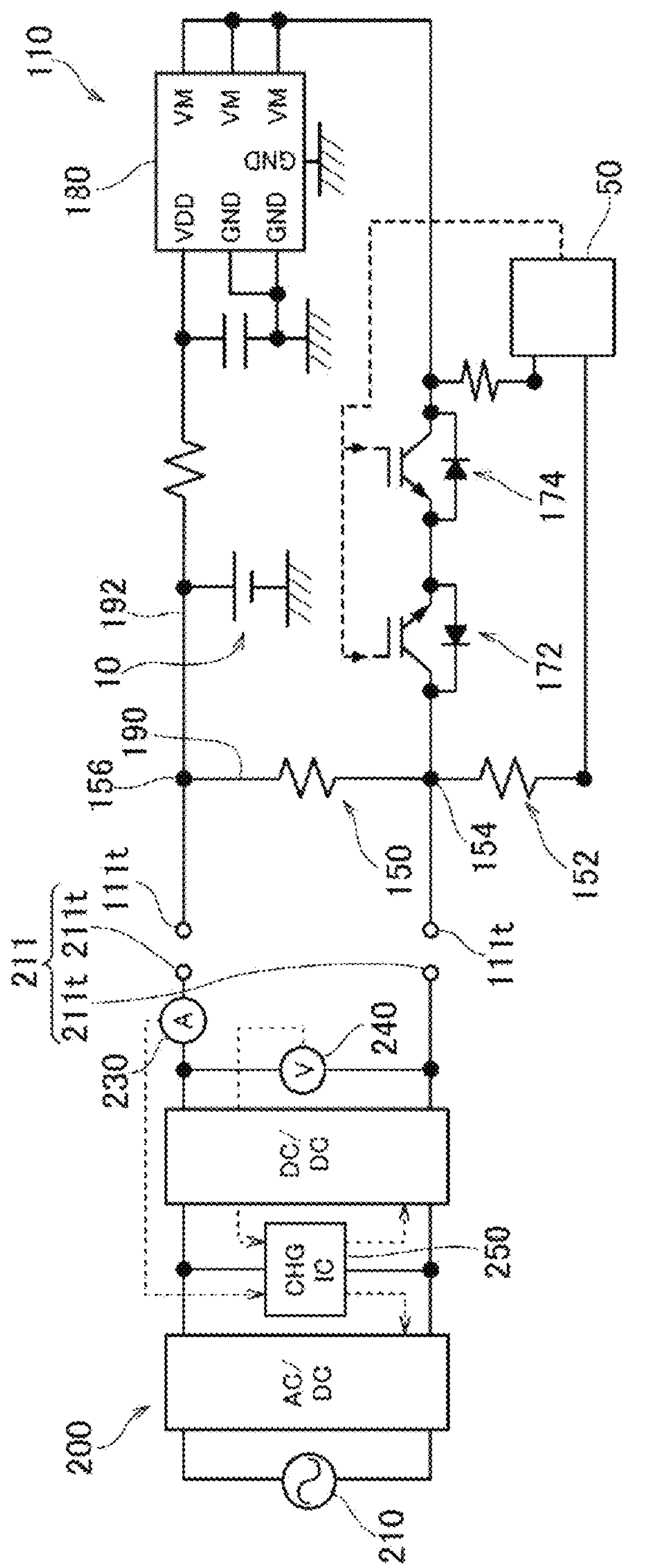

110
180
VDD
GND
GND
VM
VM
VM
GND
50
192
10
190
156
150
154
152
174
172
111t
111t
211
211t
211t
230
240
DC/DC
CHG IC
250
AC/DC
200
210

Fig. 7

Fig. 8

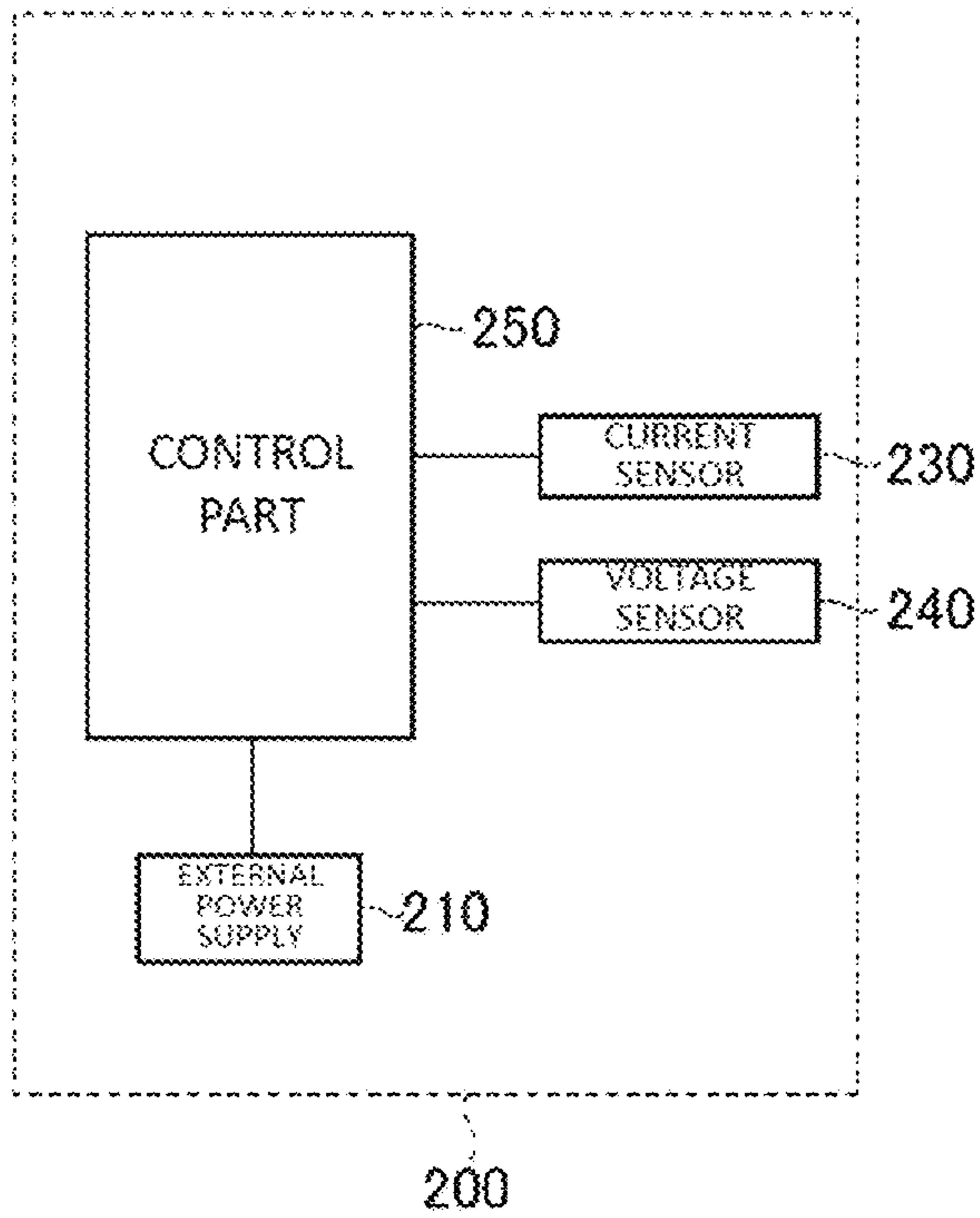

CONTROL PART
250
CURRENT SENSOR
230
VOLTAGE SENSOR
240
EXTERNAL POWER SUPPLY
210
200

Fig. 9

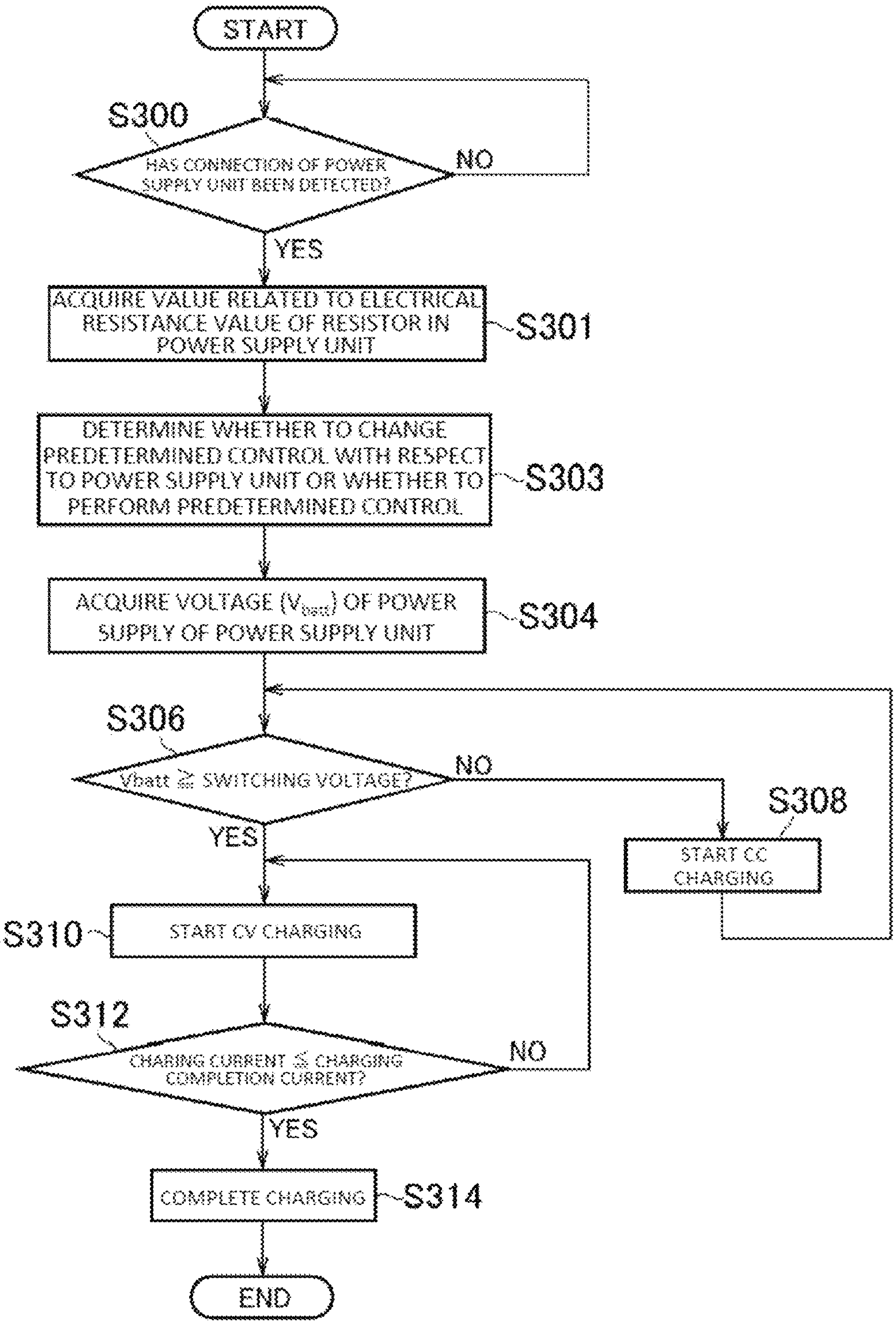

START
S300
HAS CONNECTION OF POWER SUPPLY UNIT BEEN DETECTED?
NO
YES
ACQUIRE VALUE RELATED TO ELECTRICAL RESISTANCE VALUE OF RESISTOR IN POWER SUPPLY UNIT
S301
DETERMINE WHETHER TO CHANGE PREDETERMINED CONTROL WITH RESPECT TO POWER SUPPLY UNIT OR WHETHER TO PERFORM PREDETERMINED CONTROL
S303
ACQUIRE VOLTAGE (V_{batt}) OF POWER SUPPLY OF POWER SUPPLY UNIT
S304
S306
Vbatt ≧ SWITCHING VOLTAGE?
NO
S308
START CC CHARGING
YES
S310
START CV CHARGING
S312
CHARING CURRENT ≦ CHARGING COMPLETION CURRENT?
NO
YES
COMPLETE CHARGING
S314
END

Fig. 10

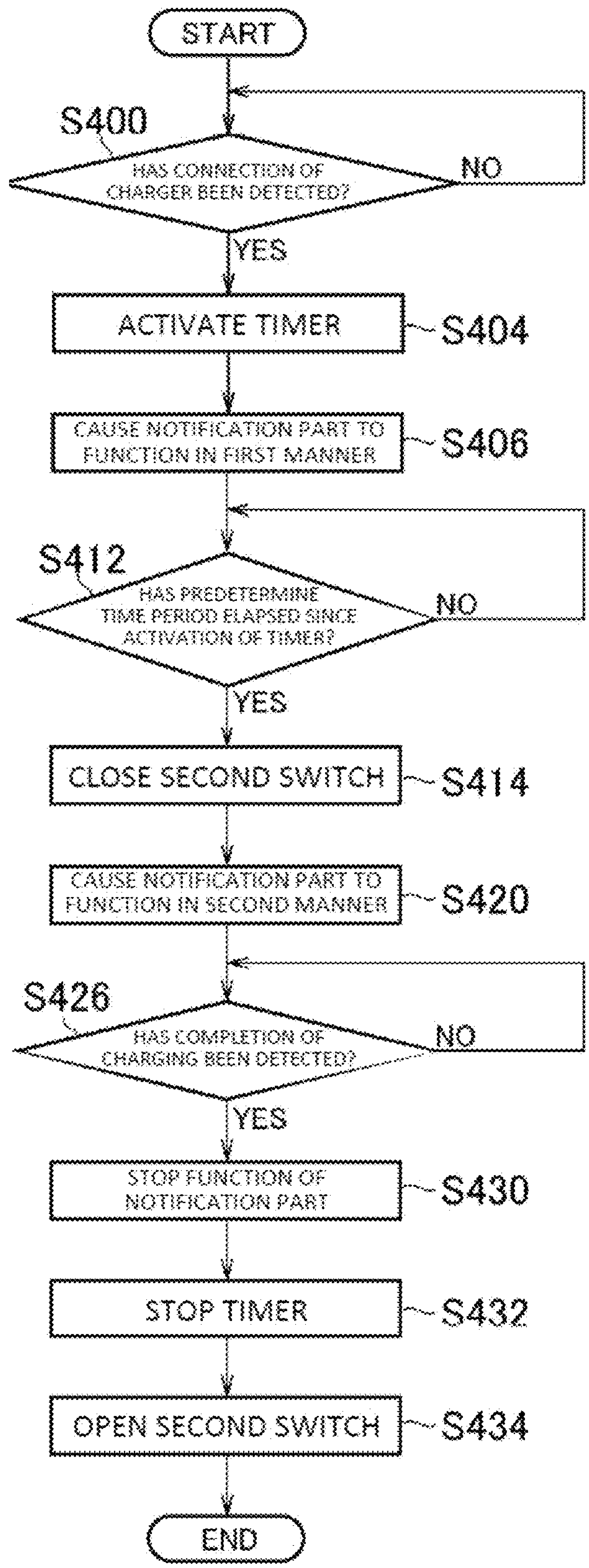

START
S400
HAS CONNECTION OF CHARGER BEEN DETECTED?
NO
YES
ACTIVATE TIMER
S404
CAUSE NOTIFICATION PART TO FUNCTION IN FIRST MANNER
S406
S412
HAS PREDETERMINE TIME PERIOD ELAPSED SINCE ACTIVATION OF TIMER?
NO
YES
CLOSE SECOND SWITCH
S414
CAUSE NOTIFICATION PART TO FUNCTION IN SECOND MANNER
S420
S426
HAS COMPLETION OF CHARGING BEEN DETECTED?
NO
YES
STOP FUNCTION OF NOTIFICATION PART
S430
STOP TIMER
S432
OPEN SECOND SWITCH
S434
END

Fig. 11

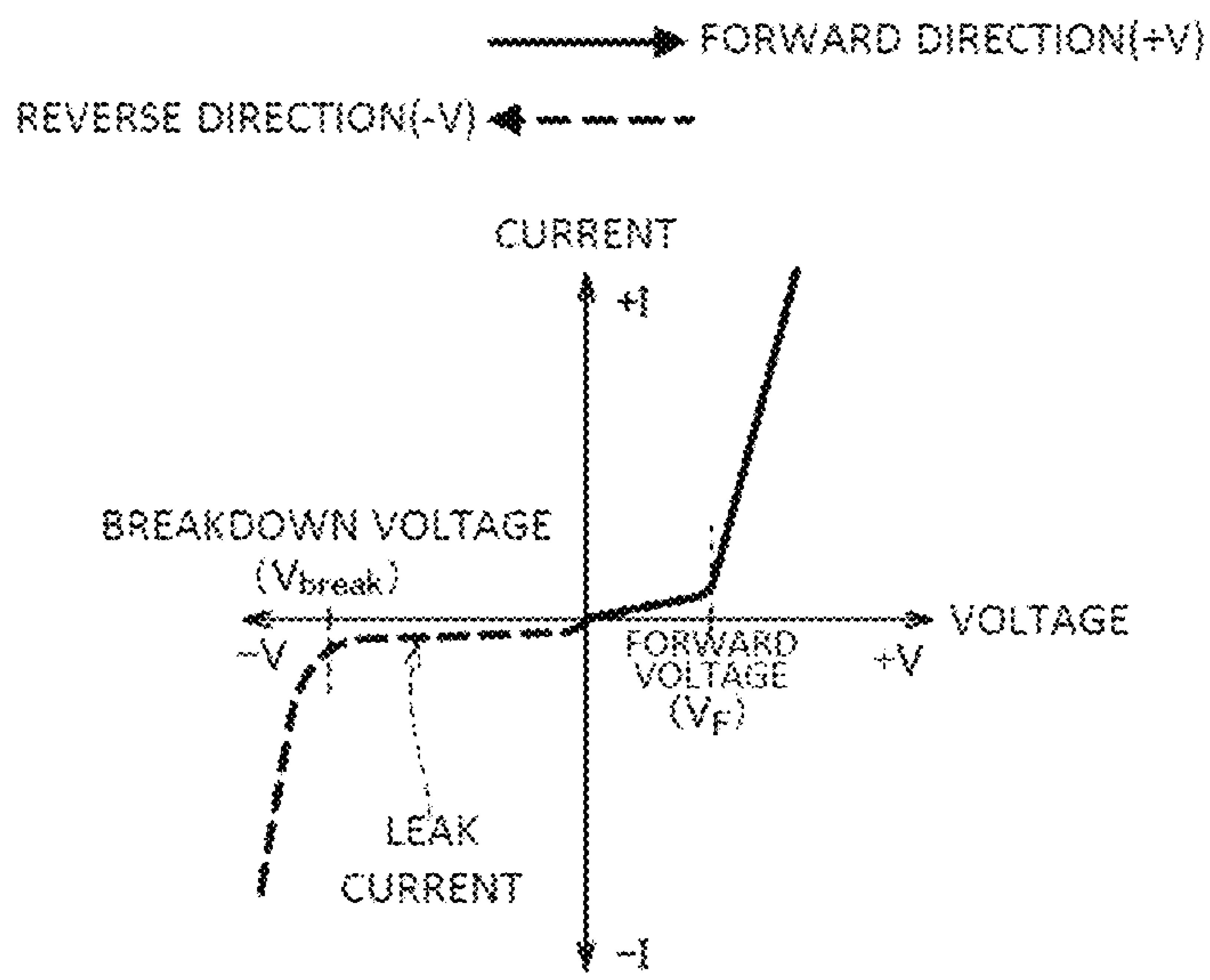
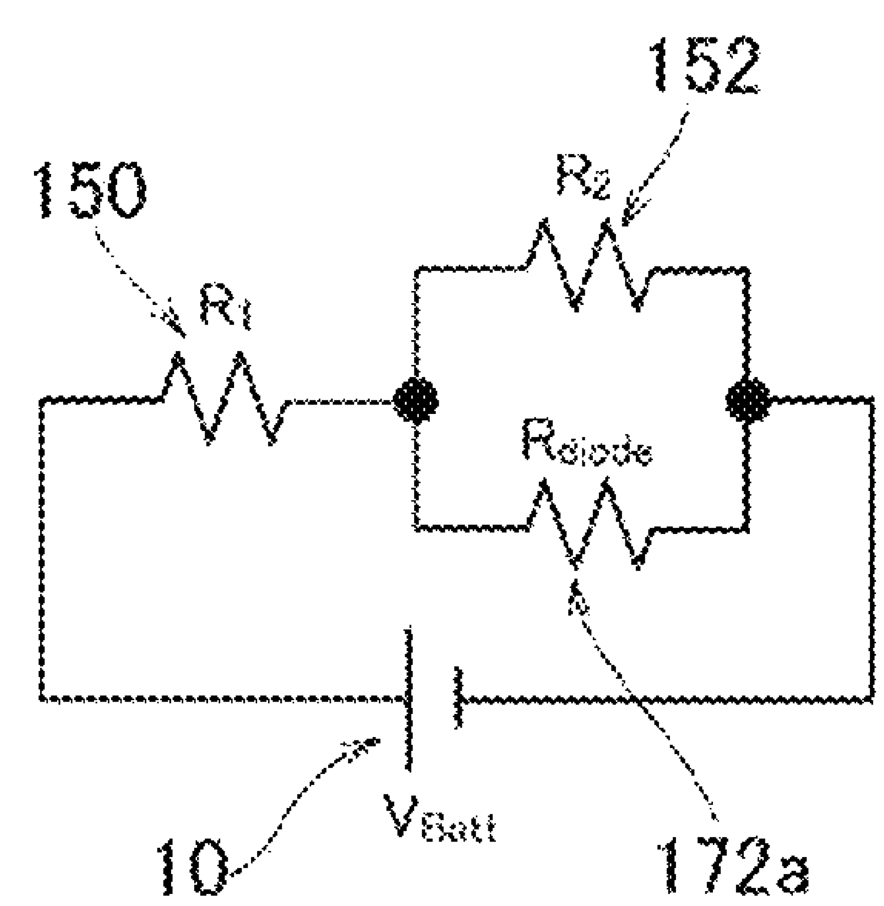

FORWARD DIRECTION(+V)
REVERSE DIRECTION(-V)
CURRENT
+I
BREAKDOWN VOLTAGE
(V_{break})
-V
VOLTAGE
FORWARD
VOLTAGE
(V_F)
+V
LEAK
CURRENT
-I

Fig. 12


152
R_2
150
R_1
R_{diode}
V_{Batt}
10
172a

EXTERNAL UNIT FOR INHALATION COMPONENT GENERATION DEVICE, INHALATION COMPONENT GENERATION SYSTEM, METHOD FOR CONTROLLING EXTERNAL UNIT FOR INHALATION COMPONENT GENERATION DEVICE, AND NON-TRANSITORY COMPUTER READABLE MEDIUM

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a Continuation of PCT International Application No. PCT/JP2018/003551, filed on Feb. 2, 2018, which is hereby expressly incorporated by reference into the present application. This application is related to U.S. Ser. No. 16/941,620, filed on Jul. 29, 2020, entitled: POWER SUPPLY UNIT OF INHALATION COMPONENT GENERATION DEVICE, AND METHOD OF SELECTING ELECTRICAL RESISTANCE VALUE OF KNOWN RESISTOR IN POWER SUPPLY UNIT OF INHALATION COMPONENT GENERATION DEVICE.

TECHNICAL FIELD

The present invention relates to an external unit for an inhalation component generation device, an inhalation component generation system, a method of controlling an external unit for an inhalation component generation device, and a program.

BACKGROUND ART

Instead of a conventional cigarette, there has been proposed an inhalation component generation device (an electronic cigarette or heated tobacco) used for tasting an inhalation component generated by vaporizing or atomizing a flavor source such as tobacco or an aerosol source with a load such as a heater (PTL 1 to PTL 3). Such an inhalation component generation device includes a load that vaporizes or atomizes a flavor source and/or an aerosol source, a power supply that supplies electric power to the load, and a control unit that controls the charge and discharge of the power supply and the load. Since the power supply that supplies the electric power to the load is formed by a secondary battery or the like, the power supply can be charged by a charger.

PTL 1 and PTL 2 each disclose that a charging mode is selected according to a current and a voltage during the charging process. PTL 3 discloses that a charging mode is changed by communication between a battery unit having a power supply and a charger.

PTL 4 to PTL 6 each disclose a technique relating to a change of a charging mode in a technical field different from that of an inhalation component generation device.

CITATION LIST

Patent Literature

PTL 1: U.S. Pat. No. 9,502,917

PTL 2: U.S. Patent No. 2015/0189917

PTL 3: International Publication No. 2015/175700

PTL 4: Japanese Patent No. 5193619

PTL 5: Japanese Patent Laid-Open No. 2014-143901

PTL 6: Japanese Patent No. 5151506

SUMMARY OF INVENTION

A first feature provides an external unit for an inhalation component generation device, the external unit including a

connection part that is electrically connectable to a power supply unit of the inhalation component generation device, a sensor that is capable of outputting an output value related to an electrical resistance value of a resistor provided in the power supply unit, and a first control part that is configured to determine, based on the output value, whether to change a predetermined control with respect to the power supply unit connected to the connection part or whether to perform the predetermined control.

The second feature provides the external unit for an inhalation component generation device according to the first feature, wherein the external unit is a charger, and the predetermined control is a control for charging a power supply provided in the power supply unit.

The third feature provides the external unit for an inhalation component generation device according to the second feature, wherein the first control part is configured to change at least one of a current value, a rate, and a charging time period for charging the power supply as the predetermined control, based on the output value.

The fourth feature provides the external unit for an inhalation component generation device according to the second feature or the third feature, wherein the first control part is configured not to charge the power supply or configured to output an abnormal signal when the output value is outside a predetermined range or does not satisfy a predetermined condition, and the first control part is configured to charge the power supply or configured not to output the abnormal signal when the output value is within the predetermined range or satisfies the predetermined condition.

The fifth feature provides the external unit for an inhalation component generation device according to any one of the first feature to the fourth feature, wherein the first control part is configured to be capable of detecting connection of the power supply unit to the connection part, and the first control part is configured to determine whether to change the predetermined control or whether to perform the predetermined control, based on the output value output after the connection of the power supply unit is detected.

The sixth feature provides an inhalation component generation system including the external unit for an inhalation component generation device according to any one of the first feature to the fifth feature, and the power supply unit.

The seventh feature provides the inhalation component generation system according to the sixth feature, wherein an electrical resistance value of the resistor is constant irrespective of a state of the power supply.

The eighth feature provides the inhalation component generation system according to the sixth feature or the seventh feature, wherein the resistor has a known electrical resistance value.

The ninth feature provides the inhalation component generation system according to any one of the sixth feature to the eighth feature, wherein the power supply unit includes a first electrical path that is electrically connected to the external unit through the resistor, a second electrical path that is electrically connected to the external unit while bypassing the resistor, and a switch configured to be capable of opening and closing the second electrical path, and the switch is configured to be closed while the predetermined control is performed.

The tenth feature provides the inhalation component generation system according to any one of the sixth feature to the ninth feature, wherein the power supply unit includes a second control part, the second control part is configured to be capable of controlling between a first mode in which the connection part is electrically disconnected from the power supply or the second control part and a second mode in which the connection part is electrically connected to the power supply or the second control part, and the first control part is configured to determine whether to change the predetermined control or whether to perform the predetermined control, based on the output value acquired during the first mode.

The eleventh feature provides the inhalation component generation system according to the tenth feature, wherein the second control part is configured to transition the power supply unit from the first mode to the second mode after an elapse of a predetermined time period since detection of the connection of the external unit.

The twelfth feature provides the inhalation component generation system according to the eleventh feature, wherein the first control part is configured to determine whether to change the predetermined control or whether to perform the predetermined control, based on the output value the is output before the predetermined time period elapses since detection of the connection of the power supply unit or an electrical resistance value of the resistor that is acquired by the sensor before the predetermined time period elapses since detection of the connection of the power supply unit.

The thirteenth feature provides the inhalation component generation system according to the eleventh feature or the twelfth feature, wherein the predetermined time period is equal to or longer than a time period required from when the first control part detects the connection of the power supply unit until the first control part acquires the electrical resistance value of the resistor.

The fourteenth feature provides the inhalation component generation system according to any one of the eleventh feature to the thirteenth feature further including a notification part, wherein the first control part or the second control part is configured to cause the notification part to function in at least partial time period of the predetermined time period.

The fifteenth feature provides the inhalation component generation system according to any one of the eleventh feature to the fourteenth feature further including a notification part, wherein the first control part or the second control part is configured to cause the notification part to function in manners different after the elapse of the predetermined time period and within the predetermined time period, or cause the notification part to function only one of after the elapse of the predetermined time period and for the predetermined time period.

The sixteenth feature provides the inhalation component generation system according to any one of the tenth feature to the fifteenth feature, wherein a control cycle of the first control part is shorter than the control cycle of the second control part.

The seventeenth feature provides an inhalation component generation system including the external unit for an inhalation component generation device according to any one of the first feature to the fifth feature, and a plurality of the power supply units, wherein the sensor is capable of outputting an output value related to an electrical resistance value of the resistor provided in each of the power supply units, the resistor is connected in parallel with a power supply of the power supply unit with respect to the connection part, the external unit is a charger, the power supply unit includes a switch that is capable of electrically connecting and disconnecting the power supply to/from the external unit and is configured to be closed while the predetermined control is performed, and the electrical resistance value of the resistor in each of the plurality of the power supply units becomes higher as the power supply unit is chargeable at a higher rate.

The eighteenth feature provides a method of controlling an external unit for an inhalation component generation device, the method including the steps of acquiring an output value related to an electrical resistance value of a resistor provided in the power supply unit by the external unit, and determining whether to change a predetermined control with respect to the power supply unit electrically connected to the external unit or whether to perform the predetermined control, based on the output value.

The nineteenth feature provides a program causing an external unit for an inhalation component generation device to execute the method according to the eighteenth feature.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a schematic diagram of an inhalation component generation device according to one embodiment.

FIG. **2** is a schematic diagram of an atomizing unit according to one embodiment.

FIG. **3** is a block diagram of the inhalation component generation device.

FIG. **4** is a diagram illustrating an electrical circuit of the power supply unit.

FIG. **5** is a diagram illustrating an electrical circuit of the inhalation component generation device including the power supply unit and the atomizing unit.

FIG. **6** is a diagram illustrating an example of a configuration of a detecting part that detects a voltage drop amount of a second resistor in the power supply unit.

FIG. **7** is a diagram illustrating an electrical circuit of an inhalation component generation system including the power supply unit and a charger **200** for the inhalation component generation device.

FIG. **8** is a block diagram of the charger.

FIG. **9** is a flowchart illustrating an example of a control method by the charger.

FIG. **10** is a flowchart illustrating an example of a control method of the power supply unit in a charging control.

FIG. **11** is a graph showing characteristics of a parasitic diode of a switch.

FIG. **12** is a diagram illustrating an equivalent circuit of an electrical circuit in the power supply unit to which the atomizing unit and the external unit are not connected.

DESCRIPTION OF EMBODIMENTS

Hereinafter, embodiments will be described. Note that the same or similar parts are denoted by the same or similar reference signs in the description of the drawings below. However, it should be noted that the drawings are schematic and ratios in dimensions may be different from actual ones.

Therefore, specific dimensions and the like should be determined with reference to the following description. Moreover, it is a matter of course that a part included in drawings mutually may have different dimensional relationships and ratios between the drawings.

[Outline of Disclosure]

The design of a device such as a power supply unit of an inhalation component generation device may be changed from various perspectives. Even when the design is thus changed, the power supply unit after the design change may be configured to be connectable to an external unit that is the same as the external unit to which the power supply unit before the design change is connected, in view of ensuring compatibility and sharing components. In this case, the external unit cannot necessarily perform an optimal control for various types of external units. Alternatively, likewise, the external unit cannot necessarily perform an optimal control for various types of power supply units, when the design of the external unit for an inhalation component generation device is changed from various perspectives.

An external unit for an inhalation component generation device according to one aspect includes a connection part that is electrically connectable to a power supply unit of the inhalation component generation device, a sensor that is capable of outputting an output value related to an electrical resistance value of a resistor provided in the power supply unit, and a first control part that is configured to determine, based on the output value, whether to change a predetermined control with respect to the power supply unit connected to the connection part or whether to perform the predetermined control.

An inhalation component generation system according to one aspect includes the external unit for an inhalation component generation device according to the above-described aspect, and the power supply unit.

A method of controlling a power supply unit of an inhalation component generation system according to one aspect includes the steps of acquiring an output value related to an electrical resistance value of a resistor provided in the power supply unit by the external unit, and determining whether to change a predetermined control with respect to the power supply unit electrically connected to the external unit or whether to perform the predetermined control, based on the output value.

According to the above-described aspect, the external unit can distinguish the type of the power supply unit or the power supply in the power supply unit, using the value related to the electrical resistance value of the resistor in the power supply unit. That is, the external unit can distinguish the type of the power supply unit or the power supply without communicating with the power supply unit, by changing the electrical resistance value of the resistor to be output according to a different type of power supply unit or power supply. Furthermore, the external unit can distinguish the type of the power supply unit or the power supply without being provided with a memory that stores, in the power supply unit, information according to the type of the power supply unit or the power supply. Accordingly, the external unit can perform an optimal control for the power supply unit according to the type of the power supply unit or the power supply.

(Inhalation Component Generation Device)

Hereinafter, an inhalation component generation device according to a first embodiment will be described. FIG. **1** is a schematic diagram of an inhalation component generation device according to one embodiment. FIG. **2** is a schematic diagram of an atomizing unit according to one embodiment. FIG. **3** is a block diagram of the inhalation component generation device. FIG. **4** is a diagram illustrating an electrical circuit of the power supply unit. FIG. **5** is a diagram illustrating an electrical circuit of the inhalation component generation device including the power supply unit and the atomizing unit. FIG. **6** is a diagram illustrating an example of a configuration of a detecting part that detects a voltage drop amount of a second resistor in the power supply unit.

An inhalation component generation device **100** may be a non-combustion-type flavor inhaler for inhaling an inhalation component (an inhaling flavor component) without combustion. The inhalation component generation device **100** may extend along a direction from a non-inhalation port end E**2** toward an inhalation port end E**1**. In this case, the inhalation component generation device **100** may include one end E**1** having an inhalation port **141** for inhaling an inhalation component and the other end E**2** opposite to the inhalation port **141**.

The inhalation component generation device **100** may include a power supply unit **110** and an atomizing unit **120**. The atomizing unit **120** may be configured to be detachably attached to the power supply unit **110** through connection parts **111** and **121**. When the atomizing unit **120** and the power supply unit **110** are mechanically connected to each other, a load **121**R (described later) in the atomizing unit **120** is electrically connected to a power supply **10** provided in the power supply unit **110** through electrical terminals **111***t* and **121***t*. That is, the electrical terminals **111***t* and **121***t* form a connection part capable of electrically connecting and disconnecting the load **121**R to/from the power supply **10**. Note that as described later, the connection part **111** of the power supply unit **110** may be configured to be connectable to an external unit that is different from the atomizing unit **120**.

The atomizing unit **120** includes an inhalation component source to be inhaled by a user, and the load **121**R that vaporizes or atomizes the inhalation component source with electric power from the power supply **10**. The inhalation component source may include an aerosol source that generates aerosol and/or a flavor source that generates a flavor component.

The load **121**R may be any element capable of generating an inhalation component, i.e., aerosol and/or a flavor component from an aerosol source and/or a flavor source by receiving the electric power. The load **121**R may be, for example, a heat generating element such as a heater or an element such as an ultrasound generator. Examples of the heat generating element include a heat generation resistor, a ceramic heater, and an induction heating type heater.

Hereinafter, a more detailed example of the atomizing unit **120** will be described with reference to FIG. **1** and FIG. **2**. The atomizing unit **120** may include a reservoir **121**P, a wick **121**Q, and the load **121**R. The reservoir **121**P may be configured to store a liquid aerosol source or flavor source. The reservoir **121**P may be, for example, a porous body made of a material such as a resin web. The wick **121**Q may be a liquid holding member that draws the aerosol source or the flavor source from the reservoir **121**P using capillary action. The wick **121**Q may be made of, for example, glass fiber or porous ceramic.

The load **121**R atomizes the aerosol source held by the wick **121**Q or heats the flavor source held by the wick **121**Q. The load **121**R is formed of, for example, a resistive heating element (for example, a heating wire) wound around the wick **121**Q.

The air that has flowed in from an inlet hole **122**A passes through the vicinity of the load **121**R in the atomizing unit **120**. The inhalation component generated by the load **121**R flows together with the air toward the inhalation port.

The aerosol source may be a liquid at ordinary temperature. For example, polyhydric alcohol such as glycerin and propylene glycol, water or the like may be used as the aerosol source. The aerosol source itself may contain the flavor component. Alternatively, the aerosol source may include a tobacco raw material or an extract deriving from the tobacco raw material that emits an inhaling flavor component by being heated.

Note that, although an example of the liquid aerosol source at ordinary temperature has been described in detail in the above-described embodiment, an aerosol source that is a solid at ordinary temperature may be also used instead of the liquid aerosol source.

The atomizing unit **120** may include a replaceable flavor unit (cartridge) **130**. The flavor unit **130** includes a cylindrical body **131** that accommodates the flavor source. The cylindrical body **131** may include a membrane member **133** and a filter **132**. The flavor source may be provided in a space formed by the membrane member **133** and the filter **132**.

The atomizing unit **120** may include a breaking part **90**. The breaking part **90** is a member for breaking a part of the membrane member **133** of the flavor unit **130**. The breaking part **90** may be held by a partition wall member **126** for partitioning into the atomizing unit **120** and the flavor unit **130**. The partition wall member **126** is made of, for example, a polyacetal resin. The breaking part **90** is, for example, a cylindrical hollow needle. An airflow path that pneumatically communicates between the atomizing unit **120** and the flavor unit **130** is formed by puncturing the membrane member **133** with a tip of the hollow needle. Here, it is preferable that an inside of the hollow needle is provided with a mesh having a roughness of not allowing the flavor source to pass through.

According to an example of the preferred embodiment, the flavor source in the flavor unit **130** imparts the inhaling flavor component to the aerosol generated by the load **121**R of the atomizing unit **120**. The flavor imparted to the aerosol by the flavor source is sent to the inhalation port **141** of the inhalation component generation device **100**. Thus, the inhalation component generation device **100** may have a plurality of inhalation component sources, i.e., the aerosol source and the flavor source. Alternatively, the inhalation component generation device **100** may have only one inhalation component source.

The flavor source in the flavor unit **130** may be a solid at ordinary temperature. By way of example, the flavor source comprises an ingredient piece of a plant material which imparts the inhaling flavor component to the aerosol. Shredded tobacco or a forming body obtained by forming a tobacco material such as a tobacco raw material in a granular form, may be used as an ingredient piece which is a component of the flavor source. Alternatively, the flavor source may comprise a forming body obtained by forming a tobacco material into a sheet form. Also, the ingredient piece, which is a component of the flavor source, may comprise a plant (for example, mint, herb, and the like) other than tobacco. The flavor source may be provided with flavor such as menthol.

The inhalation component generation device **100** may include a mouthpiece **142** having the inhalation port **141** through which a user inhales the inhalation component. The mouthpiece **142** may be configured to be detachably attached to the atomizing unit **120** or the flavor unit **130**, or may be configured to be an integral part of the atomizing unit **120** or the flavor unit **130**.

The power supply unit **110** may include the power supply **10**, a notification part **40**, and a control part **50**. The power supply **10** stores the electric power necessary for the operation of the inhalation component generation device **100**. The power supply **10** may be detachably attached to the power supply unit **110**. The power supply **10** may be, for example, a rechargeable secondary battery such as a lithium ion secondary battery.

For example, a microcontroller is used for the control part **50**. The control part **50** may configure a control unit by connecting an inhalation sensor **20** and a push button **30**. In addition, the inhalation component generation device **100** may include a sensor (not illustrated) that acquires a voltage of the power supply **10** where appropriate. Furthermore, the inhalation component generation device may include a protective IC **180** that protects the power supply **10** from overvoltage and overdischarge where appropriate. The control part **50** performs various types of control necessary for the operation of the inhalation component generation device **100**. For example, the control part **50** may constitute a power control part that controls the electric power from the power supply **10** to the load **121**R.

When the atomizing unit **120** is connected to the power supply unit **110**, the load **121**R provided in the atomizing unit **120** is electrically connected to the power supply **10** of the power supply unit **110** (see FIG. **5**).

The inhalation component generation device **100** may include a first switch **172** capable of electrically connecting and disconnecting the load **121**R to/from the power supply **10**. The first switch **172** may be comprised of, for example, a MOSFET.

The first switch **172** is closed in a state in which the atomizing unit **120** is connected to the power supply unit **110**, that is, when the first switch **172** is turned on, the electric power is supplied from the power supply **10** to the load **121**R. On the other hand, when the first switch **172** is turned off, the supply of the electric power from the power supply **10** to the load **121**R is stopped. The turning on and off of the first switch **172** is controlled by the control part **50**.

The control part **50** may include a request sensor capable of outputting a signal requesting the operation of the load **121**R. The request sensor may be, for example, the push button **30** to be pressed by a user, or the inhalation sensor **20** that detects a user's inhaling operation. The inhalation sensor **20** may be a sensor that outputs a value (for example, a voltage value or a current value) that changes according to the flow rate of air (i.e., a user's puff operation) inhaled from the non-inhalation port side toward the inhalation port side. Examples of such a sensor include a condenser microphone sensor, and a known flow sensor.

The control part **50** acquires an operation request signal to the load **121**R from the above-described request sensor and generates a command for operating the load **121**R. In a specific example, the control part **50** outputs the command for operating the load **121**R to the first switch **172**. The first switch **172** is turned on according to this command. Thus, the control part **50** is configured to control the supply of the electric power from the power supply **10** to the load **121**R. When the electric power is supplied from the power supply **10** to the load **121**R, the inhalation component source is vaporized or atomized by the load **121**R. The inhalation component containing the vaporized or atomized inhalation component source is inhaled by the user through the inhalation port **141**.

The control part **50** may perform a pulse width modulation (PWM) control with respect to the first switch **172** when acquiring the operation request signal. Note that the control part **50** may perform a pulse frequency modulation (PFM) control, instead of the PWM control. A duty ratio in the PWM control and a switching frequency in the PFM control may be adjusted by various parameters such as a voltage of the power supply **10**.

Next, an example of a detailed configuration of the electrical circuit in the power supply unit **110** will be described. In the present embodiment, the power supply unit **110** may include a first resistor **150** and a second resistor **152** that are electrically connected to each other in series. The first resistor **150** is electrically connected to the power supply **10**.

It is preferable that the electrical resistance values of the first resistor **150** and the second resistor **152** are known. That is, the first resistor **150** may be a resistor known to the control part **50** and the external unit. More preferably, the electrical resistance value of the first resistor **150** is constant irrespective of the state of the power supply **10**. Similarly, the second resistor **152** may be a resistor known to the control part **50** and the external unit. More preferably, the electrical resistance value of the second resistor **152** is constant irrespective of the state of the power supply **10**.

The electrical circuit in the power supply unit **110** may include a first electrical path (hereinafter, also referred to as an "authentication circuit") **190** that is electrically connected to the external unit through the first resistor **150**, and a second electrical path (hereinafter, also referred to as a "charging circuit") **192** that is electrically connected to the external unit while bypassing the first resistor **150**. More specifically, the first resistor **150** is provided in the first electrical path **190** from one of a pair of electrical terminals **111***t* to the other of the pair of electrical terminals **111***t*. The second electrical path **192** branches off from the first electrical path **190**. The second electrical path **192** extends from one of the pair of electrical terminals **111***t* to the other of the pair of electrical terminals **111***t* while bypassing the first resistor **150**. That is, the other of the pair of electrical terminals **111***t* is electrically connected to a first node **154** between the first resistor **150** and the second resistor **152**. One of the pair of electrical terminals **111***t* is electrically connected to a second node **156** that is disposed at a side opposite to the first node **154** with respect to the first resistor **150**. The second electrical path **192** may branch off from the first electrical path **190** at the first node **154** and the second node **156**. That is, the second electrical path (charging circuit) **192** is electrically connected in parallel with the first electrical path **190** (authentication circuit) with respect to the pair of electrical terminals **111***t*. In other words, the first electrical path **190** (authentication circuit) and the second electrical path (charging circuit) **192** are electrically connected to each other in parallel by the first node **154** and the second node **156**.

The power supply **10** and the control part **50** are provided in the second electrical path **192**. In addition, the power supply unit **110** may include the first switch **172** and a second switch **174** that are provided in the second electrical path **192**. Each of the first switch **172** and the second switch **174** may be comprised of, for example a MOSFET. The first switch **172** and the second switch **174** are controlled by the control part **50**. In addition, the first switch **172** and the second switch **174** may function as so-called discharging FET and charging FET, respectively.

The first switch **172** can transition between an open state and a closed state. The open state refers to a state in which a current output from the power supply **10** is blocked from flowing into the first switch **172** through the first node **154** when the external unit such as a charger **200** is not connected to the connection part **111**. The closed state refers to a state in which the current output from the power supply **10** flows into the first switch **172** through the first node **154** when the external unit such as the charger **200** is not connected to the connection part **111**. The first switch **172** is electrically connected to the first node **154**. Note that the first switch **172** may include a parasitic diode so that the flowing direction of the current output from the power supply **10** that flows into the first switch **172** through the first node **154** is a reverse direction when the external unit such as the charger **200** is not connected to the connection part **111**.

In other words, the first switch **172** can transition between the open state in which the current flows from a high potential side to a low potential side of the power supply **10** is blocked and the closed state in which the current flows from the high potential side to the low potential side of the power supply **10**. The first switch **172** is electrically connected to the first node **154**. Note that the first switch **172** may include a parasitic diode so that the direction from the high potential side to the low potential side of the power supply **10** is the reverse direction.

The second switch **174** may be capable of transitioning between an open state in which a charging current that is input from the connection part **111** and charges the power supply **10** is blocked and a closed state in which the charging current that is input from the connection part **111** and charges the power supply **10** flows. The second switch **174** is electrically connected to the first node **154** through the first switch **172**. Note that the second switch **174** may include a parasitic diode so that the flowing direction of the charging current that is input from the connection part **111** and charges the power supply **10** is the reverse direction.

In other words, the second switch **174** may be capable of transitioning between the open state in which the current flowing from a low potential side to a high potential side of the power supply **10** is blocked and the closed state in which the current flows from the low potential side to the high potential side of the power supply **10**. The first switch **172** is electrically connected to the first node **154**. Note that the second switch **174** may include a parasitic diode so that the direction from the high potential side to the low potential side of the power supply **10** is a forward direction.

The control part **50** may be configured to be capable of detecting a voltage drop amount in the second resistor **152**. That is, the control part **50** may include a detecting part that acquires the voltage drop amount in the second resistor **152**. An example of this detecting part will be described using FIG. **6**. FIG. **6** illustrates the first resistor **150**, the second resistor **152**, and a part of a configuration of the control part **50**.

The detecting part of the control part **50** includes a comparator **162**, a capacitor **164**, and a reference voltage source **166**. The capacitor **164** may be connected to the second resistor **152** and an inverting input terminal of the comparator **162**. The reference voltage source **166** may be connected to a non-inverting input terminal of the comparator **162**. The reference voltage source **166** may be generated from the power supply **10** using a divider circuit or a linear dropout (LDO) regulator. The comparator **162** converts from an analog voltage value that is a difference between the voltage value input to the inverting input terminal and the voltage value input to the non-inverting input terminal or a value obtained by amplifying the difference, to a digital voltage value V_{wake} based on a predetermined correlation (conversion table), and outputs the digital voltage value V_{wake}. The output digital voltage value V_{wake} shows a voltage drop amount in the second resistor **152**. Note that the resolution involved in the conversion to digital voltage values is not limited to a particular resolution, and may be, for example, 0.05 V/bit. Note that, although an example is shown in which the detecting part that converts the analog voltage value into the digital voltage value is used to acquire the voltage drop amount in the second resistor **152**, instead of this, the detecting part that directly acquires the voltage drop amount in the second resistor **152** as a digital voltage value may be used.

The voltage drop amount in the second resistor **152** differs between the case where nothing is connected to the pair of electrical terminals **111***t* and the case where the external unit such as the charger **200** or the atomizing unit **120** is connected to the pair of electrical terminals **111***t*. Accordingly, the control part **50** can detect the connection of the external unit such as the charger **200** or the atomizing unit **120** by acquiring the voltage drop amount in the second resistor **152**.

For example, when the control part **50** detects a high-level digital voltage value V_{wake}, the control part **50** can estimate that the charger **200** is not connected to the connection part **111**. In addition, when the control part **50** detects a low-level digital voltage value V_{wake}, the control part **50** can estimate that the charger **200** is connected to the connection part **111**.

More specifically, in the state in which the charger **200** is not connected to the connection part **111**, the current flows from the power supply **10** to the control part **50** through the first resistor **150** and the second resistor **152**. Accordingly, since the voltage drop occurs in the second resistor **152** by the current flowing through the second resistor **152**, the control part **50** detects the high-level digital voltage value V_{wake}. On the other hand, if a potential of a main negative bus of the charger **200**, which is connected to one of the pair of electrical terminals **111***t* a potential of which is the same as the potential of the first node **154**, falls to the ground potential by grounding, the potential of the first node **154** falls to the ground potential by connecting the charger **200** to the connection part **111**. Accordingly, since no current flows through the second resistor **152** in the state in which the charger **200** is connected to the connection part **111**, the control part **50** detects the low-level digital voltage value V_{wake}.

As described above, the power supply unit **110** of the inhalation component generation device **100** may be configured to be connectable to an external unit that is different from the atomizing unit **120**. The external unit may be, for example, the charger **200** that charges the power supply **10** in the power supply unit **110** (see FIG. **7**). FIG. **7** is a diagram illustrating an electrical circuit of the charger **200** and the power supply unit **110**. FIG. **8** is a block diagram of the charger **200**.

The charger **200** may include a connection part **211** that is electrically connectable to the power supply unit **110**. The connection part **211** may include a pair of electrical terminals **211***t*. Here, the pair of electrical terminals **111***t* of the power supply unit **110** for electrically connecting the load **121**R can also serve as the pair of electrical terminals **111***t* of the power supply unit **110** for electrically connecting the charger **200**. That is, the pair of electrical terminals **211***t* of the charger **200** may be configured to be connectable to the pair of electrical terminals **111***t* of the power supply unit **110**. More preferably, the connection part **111** of the power supply unit **110** is configured to be exclusively connectable to one of the load **121**R that vaporizes or atomizes the inhalation component source with electric power from the power supply **10** and the external unit such as the charger **200**. In other words, the connection part **111** of the power supply unit **110** is connectable to each of the load **121**R and the external unit such as the charger **200**, but, when being connected to one of the load **121**R and the external unit such as the charger **200**, the connection part **111** of the power supply unit **110** is configured to be unable to be connected to the other of the load **121**R and the external unit such as the charger **200**.

The charger **200** may include an external power supply **210** for charging the power supply **10** in the power supply unit **110**. Alternatively, the charger **200** is configured to be electrically connectable and disconnectable to/from the external power supply **210**, and may be a device that electrically connects the power supply **10** of the power supply unit **110** to the external power supply **210**. The external power supply **210** that is electrically connectable and disconnectable to/from the charger **200** may be a storage battery that outputs a direct current. In addition, the external power supply **210** that is electrically connectable and disconnectable to/from the charger **200** may be an AC commercial power system that is output from a receptacle outlet at home. Note that the charger **200** may have any shape. By way of example, the charger **200** may be shaped similar to a universal serial bus (USB) memory having a USB terminal connectable to a USB port. In addition, by way of example, the charger **200** may be cradle-shaped for holding the power supply unit **110** or case-shaped for accommodating the power supply unit **110** therein. When the charger **200** is formed into a cradle shape or a case shape, it is preferable that the external power supply **210** is incorporated in the charger **200**, and has size and weight that can be carried by a user.

The charger **200** may include a control part **250** that controls charging of the power supply **10**. Furthermore, the charger **200** may include a current sensor **230** and a voltage sensor **240**, where appropriate. The current sensor **230** acquires a charging current to be supplied from the charger **200** to the power supply **10**. The voltage sensor **240** acquires a voltage difference between the pair of electrical terminals **211***t* of the charger **200**. The control part **250** of the charger **200** uses an output value from the current sensor **230** and/or the voltage sensor **240** to control the charging of the power supply **10** of the power supply unit **110**.

In the case where the external power supply **210** is an alternating current power supply, the charger **200** may include an inverter that converts an alternating current into a direct current. In addition, the charger **200** may further include a voltage sensor that acquires a direct-current voltage output from the inverter, and a converter capable of boosting and/or stepping down the direct-current voltage output by the inverter.

Note that the configuration of the charger **200** is not limited to the above-described configuration, and may be comprised of a divider circuit, LDO, or the like or may include these divider circuit, LDO and the like.

The charger **200** includes a sensor that can output an output value related to an electrical resistance value of the first resistor **150** provided in the power supply unit **110**. The output value related to the electrical resistance value may be an electrical resistance value itself, or may be a physical quantity that can be converted into the electrical resistance value. For example, the output value related to the electrical resistance value may be a voltage drop amount (potential difference) in the first resistor **150**, or may be a current value of a current flowing through the first resistor **150**. Examples of the sensor that can output the output value related to the electrical resistance value of the first resistor **150** include the above-described current sensor **230** or voltage sensor **240**.

For example, when the second switch **174** of the power supply unit **110** is open, the voltage sensor **240** can output a value of a voltage applied to the first resistor **150** of the power supply unit **110**. In addition, when the second switch **174** of the power supply unit **110** is open, the current sensor **230** can output a value of a current flowing through the first resistor **150** of the power supply unit **110**. Each of the value of the voltage applied to the first resistor **150** and the value of the current flowing through the first resistor **150** is an output value related to the electrical resistance value of the first resistor **150**.

The charger **200** can distinguish the type of the power supply unit **110** or the power supply **10** in the power supply unit, using the value related to the electrical resistance value of the first resistor **150** in the power supply unit. That is, the charger **200** can distinguish the type of the power supply unit **110** or the power supply **10** without communicating with the power supply unit **110**, by changing the electrical resistance value of the first resistor **150** according to a different type of power supply unit **110** or power supply **10**.

Thus, the first resistor **150** of the power supply unit **110** can function as a known resistor used for authentication.

The control part **250** of the charger **200** may be configured to be capable of detecting whether the power supply unit **110** is connected to the connection part **211**. The connection of the power supply unit **110** to the connection part **211** can be detected by a known method. For example, the control part **250** can detect the connection of the power supply unit **110** by detecting the voltage difference between the pair of connection terminals **211***t*.

To simplify the structure of the inhalation component generation device **100**, the control part **250** of the charger **200** may be configured to be incapable of communicating with the control part **50** of the power supply unit **110**. In this case, a communication terminal for communicating between the control part **250** of the charger **200** and the control part **50** of the power supply unit **110** is unnecessary. In other words, in the connection interface with the charger **200**, the power supply unit **110** has only two electrical terminals, one for a main positive bus and the other for a main negative bus. Simplifying the structure of the inhalation component generation device **100** can improve the weight, cost and production efficiency of the inhalation component generation device **100**. Since the inhalation component generation device **100** is configured not to perform communication between the control part **250** of the charger **200** and the control part **50** of the power supply unit **110**, the standby power of the transmitter and receiver of each of the control parts **250** and **50** can be reduced, thereby improving the utilization efficiency of the electric power that is stored in the power supply **10** of the power supply unit **110** and the external power supply **210** of the charger **200**. Furthermore, since the communication between the control part **250** of the charger **200** and the control part **50** of the power supply unit **110** does not cause the malfunction, the quality of the inhalation component generation device **100** is improved.

(Charge Control by Charger)

FIG. **9** is a flowchart illustrating an example of a control method by the control part **250** of the charger **200**. The control part **250**, firstly, detects the connection of the power supply unit **110** to the charger **200** (step **S300**). The control part **250** waits until the power supply unit **110** is connected to the connection part **211** of the charger **200**.

When detecting the connection of the power supply unit **110** to the charger **200**, the control part **250** acquires a value related to the electrical resistance value of the first resistor **150** in the power supply unit **110** (step **S301**). The value related to the electrical resistance value of the first resistor **150** may be an electrical resistance value itself of the first resistor **150**, may be a voltage drop amount (potential difference) in the first resistor **150**, or may be a current value of a current flowing through the first resistor **150**.

When the control part **250** acquires the value related to the electrical resistance value of the first resistor **150**, it is preferable that the second switch **174** of the power supply unit **110** is open. More specifically, when the control part **250** acquires the value related to the electrical resistance value of the first resistor **150**, it is preferable that the power supply unit **110** is in a first mode in which the connection part **111** and the power supply **10** are electrically disconnected from each other. In this state, when a minute current is supplied from the charger **200** to the power supply unit **110**, the authentication circuit **190** including the first resistor **150** for authentication functions, whereby the control part **250** can acquire the value related to the electrical resistance value of the first resistor **150**.

Note that the control part **250** may acquire the values related to the electrical resistance value of the first resistor **150** a plurality of times and derive, from a moving average, a simple average, a weighted average and the like of these acquired values, the value related to the electrical resistance value of the first resistor **150** that is used in step S**303** (described later). Note that the plurality of values related to the electrical resistance value of the first resistor **150** may be acquired from one or more pulses of the minute current.

By the way, a surge current and a surge voltage become dominant in the outputs of the current sensor **230** and the voltage sensor **240** immediately after the minute current is supplied to the power supply unit **110** or at the timing when supply of the minute current to the power supply unit **110** is stopped. Then, the control part **250** may supply the minute current to the power supply unit **110** not in a moment but for a predetermined duration time. It is preferable that the control part **250** acquires the value related to the electrical resistance value of the first resistor **150** without the use of the values output by the current sensor **230** and the voltage sensor **240** immediately after the minute current is supplied to the power supply unit **110** or at the timing when supply of the minute current to the power supply unit **110** is stopped. In other words, it is preferable that the control part **250** acquires the value related to the electrical resistance value of the first resistor **150** using the values output by the current sensor **230** and the voltage sensor **240** at an intermediate time point of the predetermined duration time or at an time point in the vicinity of the intermediate time point.

Note that a time lag may be provided from the time point when the current sensor **230** and the voltage sensor **240** detect the value related to the electrical resistance value of the first resistor **150** until the time point when the control part **250** acquires the value related to the electrical resistance value of the first resistor **150** that is output from the current sensor **230** and the voltage sensor **240**, by combining a delay circuit with the current sensor **230** and the voltage sensor **240** for acquiring the value related to the electrical resistance value of the first resistor **150**. In the case where the charger **200** is thus configured, it is sufficient for the current sensor **230** and the voltage sensor **240** to detect the value related to the electrical resistance value of the first resistor **150** before the predetermined time period elapses since detection of the connection of the power supply unit **110** in the first mode in step **S301**. That is, it should be noted that it is not necessary that the control part **250** acquires the value related to the electrical resistance value of the first resistor **150** before the predetermined time period elapses since detection of the connection of the power supply unit **110**.

Next, the control part **250** determines whether to change a predetermined control or whether to perform the predetermined control with respect to the power supply unit **110**, based on the output value of the sensor, i.e., the value related to the electrical resistance value acquired in step S**301** (step S**303**). As in the present embodiment, when the external unit connected to the power supply unit **110** is the charger **200**, the predetermined control may be a control for charging the power supply **10** of the power supply unit **100**.

In this case, the first resistor **150** may be used as a known resistor used for authentication. That is, if the electrical resistance value of the first resistor **150** is changed according to the type of the power supply unit **110**, the control part **250** can perform an optimal control according to the type of the power supply unit **110**.

For example, when the above-described output value is outside a predetermined range or does not satisfy a predetermined condition, the control part **250** does not charge the power supply **10**. On the other hand, when the output value is within the predetermined range or satisfies the predetermined condition, the control part **250** may be configured to charge the power supply **10**. That is, the change of the predetermined control with respect to the power supply unit **110** in step S**301** includes changing such that the charging process is not performed in steps S**304** to S**314** (described later). Thus, in the case where it is determined that the power supply unit **110** is abnormal or the power supply unit **110** is an inauthentic product, no charging current is supplied, whereby the abnormal situation can be prevented from occurring. Instead of the above-described aspect or in addition to the above-described aspect, the control part **250** may be configured to output an abnormal signal in the case where the above-described output value is outside the predetermined range or does not satisfy the predetermined condition.

Instead of the above-described example, the change of the predetermined control with respect to the power supply unit **110** in step S**301** may be at least one of changes of a current value, a rate and a charging time period for charging the power supply. As a specific example, the change of the predetermined control may be a change of the rate of the charging current. That is, the control part **250** can change the rate of the charging current according to the type of the power supply unit **110** or the power supply **10**. In this manner, when the power supply **10** enabling rapid charging is used, the control part **50** can perform the charge control with a charging current at a high rate of, for example, 2 C or higher, and when the power supply **10** disabling rapid charging is used, the control part **50** can perform the charge control with a charging current at a low rate of, for example, 1 C or lower. Note that the rate of the charging current is mainly changed in CC charging (described later). To change such a predetermined control, the control part **250** of the charger **200** may include a memory that has stored the values related to the electrical resistance value of the first resistor **150** and the database associating the power supply unit **110** or the power supply **10** with charging conditions such as the rate of the charging current.

It is preferable that the control part **250** of the charger **200** is configured to determine whether to change a predetermined control or whether to perform the predetermined control, based on the output value that is output before a predetermined time period (described later) elapses since detection of the connection of the power supply unit **110**, i.e., the value related to the electrical resistance value of the first resistor **150**. The predetermined time period corresponds to a time period from when the control part **50** of the power supply unit **110** detects the connection of the charger **200** until the second switch **174** is closed.

Next, the control part **250** performs a predetermined control, i.e., the charge control in the present embodiment. For example, when the power supply **10** of the power supply unit **110** is charged, the control part **250** of the charger **200** firstly estimates a voltage of the power supply **10** using the voltage sensor **240** (step S**304**).

As will be described later, the second switch **174** may be closed while the predetermined control is performed, i.e., in the step after step S**304**. If the electrical resistance value of the first resistor **150** is sufficiently higher as compared with an internal resistance (impedance) of the power supply **10**, the charging current from the charger **200** flows mainly through the charging circuit **192** including the power supply **10**, and scarcely flows in the authentication circuit **190**. As such, it is preferable that the second switch **174** is configured to selectively cause one of the charging circuit **192** and the authentication circuit **190** to function. This can prevent loss of electric power in the power supply unit **110** during charging of the power supply **10** as compared with the case where the majority of the charging current from the charger **200** flows through the first resistor **150**.

When the voltage of the power supply **10** is equal to or higher than a discharge termination voltage, the control part **250** determines whether the voltage of the power supply **10** is equal to or higher than a switching voltage (step S**306**). The switching voltage is a threshold for dividing into a section of constant current charging (CC charging) and a section of constant voltage charging (CV charging). The switching voltage may be, for example, in the range of 4.0 V to 4.1 V.

When the voltage of the power supply **10** is less than the switching voltage, the control part **250** charges the power supply **10** by a constant current charging method (step S**308**). When the voltage of the power supply **10** is equal to or higher than the switching voltage, the control part **250** charges the power supply **10** by a constant voltage charging method (step S**310**). In the constant voltage charging method, the voltage of the power supply **10** increases as charging proceeds, and the difference between the voltage of the power supply **10** and the charging voltage is reduced, whereby the charging current decreases.

When charging of the power supply **10** is started by the constant voltage charging method, the control part **250** determines whether the charging current is equal to or smaller than a predetermined charging completion current (step S**312**). Here, the charging current can be acquired by the current sensor **230** in the charger **200**. When the charging current is larger than the predetermined charging completion current, charging of the power supply **10** is continued by the constant voltage charging method.

When the charging current is equal to or smaller than the predetermined charging completion current, the control part **250** determines that the power supply **10** is fully charged, and stops the charging (step S**314**). Note that the condition for stopping the charging include the time period that has elapsed since the start of charging by the constant current charging method or charging by the constant voltage charging method, the voltage of the power supply **10**, and the temperature of the power supply **10**, in addition to the charging current.

(Control by Control Part of Power Supply Unit in Charging Mode)

FIG. **10** is a flowchart illustrating an example of a control method by the control part **50** of the power supply unit **110** in a charging mode. The charging mode is a mode in which the power supply **10** can be charged.

Firstly, the control part **50** detects the connection of the charger **200** to the power supply unit **110** (step S**400**). The detection of the connection of the charger **200** for example, as described above, can be determined based on a voltage drop amount (Wake signal) in the second resistor **152**. Note that the second switch **174** is configured to be maintained in an open state when the charger **200** is not connected to the connection part **111** of the power supply unit **110**. In the state in which the second switch **174** is open, the power supply unit **110** is in a standby mode (first mode) in which the connection part **111** and the power supply **10** are electrically disconnected from each other.

When detecting the connection of the power charger **200** to the power supply unit **110**, the control part **50** activates a timer (step S**404**). This timer measures the time period that has elapsed since detection of the connection of the charger **200**.

Furthermore, it is preferable that the control part **50** causes the notification part **40** to function in a first manner where appropriate (step S**406**). For example, in the case where the notification part **40** is a light emitting element such as an LED, the control part **50** causes the notification part to emit light in a predetermined first light emission manner. The control part **50** may be configured to cause the notification part **40** to function in at least partial time period of the above-described predetermined time period. Note that the notification part **40** may be provided in the charger **200**, and furthermore the control part **250** of the charger may control the notification part **40** provided in the charger **200**. In the case where the control part **250** of the charger controls the notification part **40**, the control part **250** of the charger causes the notification part **40** to function in the first manner when the control part **250** of the charger detects the connection of the power supply unit **110**.

The control part **50** determines whether the predetermined time period has elapsed since detection of the connection of the charger **200** (step S**412**). The second switch **174** is maintained in the open state until the predetermined time period elapses since detection of the connection of the charger **200**. That is, the standby mode (first mode) in which the connection part **111** and the power supply **10** are electrically disconnected from each other is maintained.

When the predetermined time period elapses since detection of the connection of the charger **200**, the control part **50** closes the second switch **174** (step S**414**). When the second switch **174** is closed, the power supply unit **110** transitions to an operation mode (second mode) in which the connection part **111** and the power supply **10** are electrically connected to each other. When the control part **250** of the charger **200** starts the charging as described above (step S**308** and step S**310**) in the operation mode in which the second switch **174** is closed, charging of the power supply **10** is started.

The detection of the charger **200** by the control part **50** is the condition for transitioning from the first mode in which the authentication circuit **190** functions to the second mode in which the charging circuit **192** functions. However, in the present embodiment, after the elapse of the predetermined time period since the fulfillment of the condition for transitioning from the first mode to the second mode, it transitions from the first mode to the second mode by controlling the second switch **174**.

As described above, the control part **50** of the power supply unit **110** maintains the standby mode (first mode) until a predetermined time period elapses since detection of the connection of the charger **200**. It is preferable that this predetermined time period is equal to or longer than a time period required from when the control part **250** of the charger **200** detects the connection of the power supply unit **110** until the control part **250** of the charger **200** acquires the value related to the electrical resistance value of the first resistor **150** in the power supply unit **110**. This enables the control part **250** of the charger **200** to acquire the value related to the electrical resistance value of the first resistor **150** while the power supply unit **110** is in the standby mode (first mode).

When the control part **50** is in the operation mode (second mode) in which the second switch **174** is closed, it is preferable that the control part **50** causes the notification part **40** to function in a second manner (step S**420**). For example, in the case where the notification part **40** is a light emitting element such as an LED, the control part **50** causes the notification part **40** to emit light in a predetermined second light emission manner. Note that, as described above, the notification part **40** may be provided in the charger **200**, and furthermore the control part **250** of the charger may control the notification part **40** provided in the charger **200**. In the case where the control part **250** of the charger controls the notification part **40**, the control part **250** of the charger causes the notification part **40** to function in the second manner after the above-described predetermined time period has elapsed since the control part **250** of the charger detected the connection of the power supply unit **110**.

It is preferable that the control part **50** and/or the control part **250** cause the notification part **40** to function in different manners after the elapse of the above-described predetermined time period and within the predetermined time period. That is, it is preferable that the first manner of the notification part **40**, e.g., the first light emission manner is different from the second manner of the notification part **40**, e.g., the second light emission manner. This enables the notification part **40** to notify a user of whether the predetermined time period has elapsed.

Alternatively, the control part **50** and/or the control part **250** may be configured to cause the notification part **40** to function only one of after the elapse of the predetermined time period and for the predetermined time period. That is, the control part **50** and/or the control part **250** may cause the notification part **40** to function at at least one timing of steps S**406** and S**420**. This enables the notification part **40** to notify a user of whether the predetermined time period has elapsed.

The control part **50** determines whether to detect the completion of the charging (step S**426**). The completion of the charging is detected by detecting, for example, that the connection of the charger **200** is released. Alternatively, the completion of the charging may be detected by detecting, for example, that the charging current from the charger **200** is stopped. When detecting the completion of the charging, the control part **50** stops the function of the notification part **40** and the timer, and opens the second switch **174** (step S**430**, step S**432**, and step S**434**).

The control part **50** of the power supply unit **110** performs the above-described control flow in a predetermined control cycle. On the other hand, the control part **250** of the charger **200** may perform the above-described control flow in a control cycle different from the control cycle of the control part **50**. In this case, the control part **250** of the charger **200** can complete the above-described steps S**301** and S**303** rapidly in the period from when the control part **50** activates the timer until the predetermined time period elapses (step S**412**).

The control part **50** is configured to control the second switch **174** to thereby transition from the first mode to the second mode when the condition for transitioning from the second mode in which the charging circuit **192** functions to the first mode in which the authentication circuit **190** functions is fulfilled. For example, in the above-described flowchart, when detecting the completion of the charging, the control part **50** controls the second switch **174** to thereby transition from the first mode to the second mode. In this case, it is preferable that the control part **50** controls the second switch so that the time period (corresponding to the above-described predetermined time period) from when the condition for transitioning from the first mode to the second mode is fulfilled until the first mode is transitioned to the second mode is longer than the time period from when the condition for transitioning from the second mode to the first mode is fulfilled until the second mode is transitioned to the first mode.

(Program and Storage Medium)

The aforementioned flow illustrated in FIG. **9** can be performed by the control part **250** of the charger **200**. That is, the control part **250** may have a program that causes the charger **200** for the inhalation component generation device to execute the aforementioned flow illustrated in FIG. **9**. Furthermore, it should be noted that a storage medium in which the program is stored is also included in the scope of the present invention.

The aforementioned flow illustrated in FIG. **10** can be performed by the control part **50** of the power supply unit **110**. That is, the control part **50** may have a program that causes the power supply unit **110** for the inhalation component generation device to execute the aforementioned flow illustrated in FIG. **10**. Furthermore, it should be noted that a storage medium in which the program is stored is also included in the scope of the present invention.

(Electrical Resistance Values of First Resistor and Second Resistor)

(1) Relationship with Parasitic Diode of Switch

The present inventors found that electrical resistance values of the first resistor **150** and the second resistor **152** have preferable values from various perspectives. In an example illustrated in FIG. **4**, the first switch **172** includes a parasitic diode (also referred to as a body diode) so that the flowing direction of the current output from the power supply **10** that flows into the first switch **172** through the first node **154** is a reverse direction when the external unit such as the charger **200** is not connected to the connection part **111**. In other words, the first switch **172** includes a parasitic diode so that the direction from the high potential side to the low potential side of the power supply **10** is the reverse direction. In addition, the second switch **174** includes a parasitic diode so that the flowing direction of the charging current that is input from the connection part **111** and charges the power supply **10** is the reverse direction. In other words, the second switch **174** includes a parasitic diode so that the direction from the high potential side to the low potential side of the power supply **10** is a forward direction. Accordingly, in the case where nothing is connected to the connection part **110** of the power supply unit **110** and the first switch **172** and the second switch **174** are open, the electrical circuit in the power supply unit **110** is appropriately equivalent to a circuit illustrated in FIG. **12**. In the equivalent circuit illustrated in FIG. **12**, reference numeral **172***a* denotes a parasitic diode so that the flowing direction of the current output from the power supply **10** that flows into the first switch **172** through the first node **154** is a reverse direction. In other words, reference numeral **172***a* denotes a parasitic diode so that the direction from the high potential side to the low potential side of the power supply **10** is the reverse direction.

In the equivalent circuit illustrated in FIG. **12**, the first resistor **150** and the second resistor **152** are connected to each other in series. The parasitic diode **172***a* is connected in parallel with the second resistor **152**. Assuming that the electrical resistance value of the parasitic diode **172***a* is very high, a voltage value V_{diode} applied to the parasitic diode **172***a* is represented by the following expression.

$$V_{diode}=V_{Batt}\times R_2/(R_1+R_2)=V_{batt}/(1+R_1/R_2)$$

Where V_{Batt} represents an output voltage of the power supply **10** that can vary from a fully charged voltage to the discharge terminal voltage, R_1 represents an electrical resistance value of the first resistor **150**, and R_2 represents an electrical resistance value of the second resistor **152**. It should be noted that in the aforementioned expression, the parasitic diode or the like of the second switch **174** is omitted since it has a value that is sufficiently lower than that of the parasitic diode **172***a*.

It is known that the parasitic diode **172***a* has characteristics illustrated in FIG. **11**. FIG. **11** shows a relationship between a voltage applied to the parasitic diode **172***a* and a current flowing through the parasitic diode **172***a*. It should be noted that in FIG. **11**, a current flowing through the parasitic diode **172***a* in the forward direction and a voltage applied to cause the current flowing in the forward direction are represented using a plus (+) sign, and a current flowing through the parasitic diode **172***a* in the reverse direction and a voltage applied to cause the current flowing in the reverse direction are represented using a minus (−) sign. It should be noted that where reference is made to a magnitude of the voltage in the following description, the absolute values are used to compare two voltage values. When a reverse voltage higher than a breakdown voltage V_{Break} is applied to the parasitic diode **172***a*, that is, when a voltage on the left side of the breakdown voltage V_{Break} in FIG. **11** is applied to the parasitic diode **172***a*, the current flows through the parasitic diode **172***a* in the reverse direction, resulting in the loss of the function as the diode. In addition, even when a reverse voltage lower than a breakdown voltage V_{Break} is applied to the parasitic diode **172***a*, that is, even when a reverse voltage on the right side of the breakdown voltage V_{Break} in FIG. **11** is applied to the parasitic diode **172***a*, a minute leak current under a quantum effect flows through the parasitic diode **172***a* in the reverse direction.

When the leak current flows through the parasitic diode **172***a* of the first switch **172**, the leak current flows into the control part **50**. Therefore, in some cases, the control part **50** cannot operate normally. Consequently, it is preferable to minimize a value of the current unintentionally leaking from the parasitic diode **172***a*, that is, the first switch **172** in the open state. As shown in FIG. **11**, the leak current has correlation with the voltage applied to the parasitic diode **172***a* in the reverse direction. Even in the case where the voltage lower than the breakdown voltage V_{Break} is applied, the electrical potential of an electron causing the leak current is increased when the voltage applied in the reverse direction is increased. Consequently, it is preferable to minimize a value V_{diode} of the voltage applied to the parasitic diode **172***a*, i.e., the first switch **172**.

Accordingly, in consideration of the above-described expression, it is preferable that the electrical resistance value R_2 of the second resistor **152** is lower than the electrical resistance value R_1 of the first resistor **150**. Thus, the value of V_{diode} of the voltage applied to the parasitic diode **172***a*, i.e., the first switch **172** is reduced, whereby the leak current can be reduced.

More preferably, the ratio of the electrical resistance value R_1 of the first resistor **150** to the electrical resistance value R_2 of the second resistor **152** is designed to apply the voltage lower than the breakdown voltage to the parasitic diode **172***a* when the external unit is not connected to the connection part **111**. This can prevent the function of the parasitic diode **172***a* from being destroyed.

(2) Consideration of Dark Current

When the external unit is not connected to the connection part **111** of the power supply unit **110**, a weak dark current flows through the first resistor **150** and the second resistor **152** from the power supply **10**. It is preferable that this dark current is designed to be smaller than a value of current allowing discharging of the power supply **10** when the load **121**R of the atomizing unit **120** is connected to the connection part **111**. That is, it is preferable that the electrical resistance values R_1 and R_2 of the first resistor **150** and the second resistor **152** are designed so that a value of the current flowing through the first resistor **150** and the second resistor **152** when the external unit is not connected to the connection part **111** is smaller than a value of the current allowing discharging of the power supply **10** when the load **121**R is connected to the connection part **111**. This can prevent the power consumption of the power supply unit **110** in the standby state. Note that the current allowing discharging of the power supply **10** when the load **121**R is connected to the connection part **111** may be adjusted by the above-described PWM control or PFM control.

This dark current is related to the accuracy of the connection detection of the external unit by the detecting part of the control part **50**. That is, as described above, the detecting part of the control part **50** detects the connection of the external unit by distinguishing between the voltage drop amount of the second resistor **152** when the external unit is connected to the connection part **111** and the voltage drop amount of the second resistor **152** when the external unit is not connected to the connection part **111**. However, when the electrical resistance values of the first resistor **150** and the second resistor **152** are enormously increased, the dark current becomes enormously minute current value. As will be appreciated, the voltage drop amount of the second resistor **152** depends on the electrical resistance values of the first resistor **150** and the second resistor **152**. Accordingly, it is preferable that the first resistor **150** has the electrical resistance value such that the detecting part of the control part **50** can distinguish between the voltage drop amount of the second resistor **152** when the external unit is connected to the connection part **111** and the voltage drop amount of the second resistor **152** when the external unit is not connected to the connection part **111**.

To suppress the connection detection errors, it is desirable that the voltage drop amount V_{wake} of the second resistor **152** when the external unit is not connected is maintained at a high level higher than a predetermined threshold V_{th}. When the external unit is not connected to the power supply unit **110**, the voltage drop amount V_{wake} of the second resistor **152** is represented by "$V_{Wake}=V_{Batt}\times R_2/(R_1+R_2)$."

Here, considering that it is preferable that a relational expression "$V_{wake}>V_{th}$" is established, it is found preferable that the electrical resistance value of the first resistor **150** satisfies the following relational expression: $R_1<(V_{Batt}/V_{th}-1)\times R_2$.

This relational expression can be regarded to specify an upper limit value of the first resistor **150**.

In view of the foregoing discussion, specifically, the electrical resistance values of the first resistor **150** and the second resistor **152** may be designed so that a value of the current (dark current) flowing through the first resistor **150** and the second resistor **152** when the external unit is not connected to the connection part **111** is preferably 0.200 mA or less. This can suppress the dark current more efficiently. Note that this can also suppress the connection detection errors efficiently. In addition, the electrical resistance values of the first resistor **150** and the second resistor **152** may be designed so that a rate of the current (dark current) flowing through the first resistor **150** and the second resistor **152** when the external unit is not connected to the connection part **111** is preferably 0.07 mC or less. This can reduce the power consumption associated with the dark current efficiently while enabling the connection detection using the dark current flowing through the second resistor **152**. Note that this can also suppress the connection detection errors efficiently.

(3) Consideration of Resolution of Voltage Sensor of External Unit

As described above, the control part **250** of the external unit such as the charger **200** may include the voltage sensor **240** that can acquire the electrical resistance value of the first resistor **150** in the power supply unit **110**. In this case, it is desirable that the voltage sensor **240** outputs the electrical resistance value of the first resistor **150** accurately. Accordingly, it is preferable that the voltage drop amount in the first resistor **150** is greater than the resolution of the voltage sensor **240** when the voltage sensor **240** acquires the electrical resistance value of the first resistor **150**.

Accordingly, it is preferable that the electrical resistance value R_1 of the first resistor **150** is designed so that the voltage drop amount in the first resistor when the external unit discharges to the power supply unit at a predetermined current value is greater than the resolution of the sensor of the external unit that outputs the voltage drop amount in the first resistor **150**.

(4) Relationship with Internal Resistance of the Power Supply **10**

When the charger **200** is connected to the connection part **111** of the power supply unit **110**, the charging current from the charger **200** mainly flows into the power supply **10** from the second node **156** (see FIG. **7**). Note that a part of the current flows through the first resistor **150** without flowing into the power supply **10**. Since the current flowing through the first resistor **150** becomes a loss, it is preferable that the current flowing through the first resistor **150** is reduced as small as possible. From such viewpoints, it is preferable that the electrical resistance value R_1 of the first resistor **150** is higher than the internal resistance value $R_{impedance}$ of the power supply **10**.

(5) Relationship with Load of Atomizing Unit

When the load **121**R that vaporizes or atomizes the inhalation component source with electric power from the power supply **10** is connected to the connection part **111** of the power supply unit **110**, the current discharged from the power supply **10** mainly flows through the second node **156**, the load **121**R, the first node **154**, and the first switch **172** in this order, and then is returned to the power supply **10** (see FIG. **5**).

However, a part of the current flows through the first resistor **150** without flowing the load **121**R. Since the current flowing through the first resistor **150** becomes a loss, it is preferable that the current flowing through the first resistor **150** is reduced as small as possible. From such viewpoints, it is preferable that the electrical resistance value R_1 of the first resistor **150** is higher than the electrical resistance value R_{load} of the load **121**R.

(6) Relationship with Time Constant of RC Circuit

As illustrated in FIG. **6**, the second resistor **152** and the capacitor **164** are connected to each other in series. That is, the electrical path including the second resistor **152** and the capacitor **164** form a so-called RC circuit.

Here, when the external unit such as the charger **200** is connected to the first node **154** between the first resistor **150** and the second resistor **152**, the potential at the first node **154** changes. Since the second resistor **152** and the capacitor **164** form the RC circuit, the voltage output from this RC circuit follows a circuit equation "V_0x exp(−t/τ)+V_1" in the RC circuit. In addition, the voltage output from the RC circuit corresponds to a change in potential at the first node **154**, i.e., a change in voltage drop amount in the second resistor **152**.

Where, "V_0" represents an initial value of the potential difference, i.e., a potential difference at t=0. In the example in which the control part **50** detects the connection of the charger **200**, "V_0" corresponds to the voltage drop amount (potential difference) in the second resistor **152** when nothing is connected to the power supply unit **110**. "V_1" represent a final value of the potential difference. When the first node **154** is grounded by the charger **200**, V_1 is zero.

"t" represents a time period. In the example in which the control part **50** detects the connection of the charger **200**, "t" represents the time period that has elapsed from when the charger **200** is physically connected to the power supply unit **110**.

Furthermore, τ is generally called a time constant, and specified by the expression "τ=R×C." Where "R" represents an electrical resistance value of a resistor in the RC circuit, and "C" represents the capacitance of a capacitor in the RC circuit. In the example illustrated in FIG. **6**, "R" is an electrical resistance value of the second resistor **152**, and "C" is the capacitance of the capacitor **164**.

When the control part **50** detects the connection of the external unit to the connection part **111**, the control part **50** needs to detect the voltage drop amount in the second resistor **152** after the voltage drop amount in the second resistor **152** sufficiently approaches the final value. From such viewpoints, it is preferable that the time constant τ is small. That is, it is preferable that the electrical resistance value of the second resistor **152** is low.

More specifically, it is preferable that the electrical resistance value of the second resistor **152** is designed such that the time constant τ of the RC circuit formed by the second resistor **152** and the capacitor **164** is shorter than a cycle in which the detecting part of the control part **50** detects the voltage drop amount in the second resistor **152**. In this way, the voltage drop amount in the second resistor **152** varies to a value sufficiently close to the final value in a time period shorter than the detection cycle of the detecting part of the control part **50**. Accordingly, the control part **50** can detect the connection of the external unit to the connection part **111** of the power supply unit **110** rapidly and more accurately.

Note that the voltage drop amount in the second resistor **152** is detected by the detecting part of the control part **50** in a single sequence consecutively a plurality of times, and the control part **50** may use an average value of these detected voltage drop amounts as the voltage drop amount in the second resistor **152**. In this case, it is preferable that the electrical resistance value of the second resistor **152** is designed such that the time constant τ of the RC circuit formed by the second resistor **152** and the capacitor **164** is shorter than a cycle in which this sequence is performed.

In particular, as described above, in the case where the control part **50** of the power supply unit **110** cannot communicate with the control part **250** of the external unit such as the charger **200**, it is difficult to synchronize the control parts **50** and **250**. In this case, it is preferable that the control part **50** rapidly detects the connection of the external unit not to cause the deviation between the control by the control part **50** of the power supply unit **110** and the control by the control part **250** of the external unit such as the charger **200**.

(Inhalation Component Generation System Having a Plurality of Power Supply Units)

The present invention can be also applied to an inhalation component generation system including an external unit for an inhalation component generation device, and a plurality of power supply units that are electrically connectable to a connection part of the external unit. It is preferable that the external unit is the charger **200**. The configurations of the charger **200** and each of the power supply units **110** are as described above. Accordingly, the detailed description of configurations of the charger **200** and each of the power supply units **110** is omitted. However, the electrical resistance values of the first resistors **150** in the power supply units **110** may be different from one another.

It is preferable that the electrical resistance value of the first resistor **150** in each of the plurality of the power supply units **110** becomes higher as the power supply unit **110** has the power supply **10** that is chargeable at a higher rate. That is, the electrical resistance value of the first resistor **150** provided in each of the plurality of power supply units **110** is selected to a higher value as the power supply unit **110** has the power supply **10** that is chargeable at a higher rate.

When the charging current is supplied at a high rate in the case where the charging current is supplied from the charger **200** to the power supply **10** of the power supply unit **110**, a relatively large current flows easily in the authentication circuit **190** including the first resistor **150**. That is, as the charging current flows at a higher rate, the amount of unnecessary current that does not contribute to the charging of the power supply **10** is increased, which causes an increase in loss of electric power.

Accordingly, the electrical resistance value of the first resistor **150** in the power supply unit **110** is selected to a higher value as the power supply unit **110** has the power supply **10** that is chargeable at a higher rate. Therefore, the amount of unnecessary current that does not contribute to the charging of the power supply **10** can be suppressed even in the power supply unit **110** having the power supply **10** that is chargeable at a higher rate.

[Other Embodiments]

Although the present invention has been described by the embodiments described above, it should not be understood that the descriptions and the drawings that form a part of this disclosure limit the present invention. Various alternative embodiments, examples and operation techniques will be apparent to those skilled in the art from this disclosure.

For example, in the above-described embodiment, the external unit that is connected to the power supply unit **110** for the inhalation component generation device is mainly the charger **200**. However, the external unit is not limited to the charger **200**. The external unit may be any unit that can output the value related to the electrical resistance value of the resistor in the power supply unit and performs a predetermined control with respect to the power supply unit. Even in such a case, the external unit can distinguish the type of the power supply unit or the power supply in the power supply unit, and can perform an optimal control for the power supply unit according to the type of the power supply unit or the power supply.

What is claimed is:

1. An external unit for an inhalation component generation device, the external unit comprising:

an interface including two terminals that are configured to be electrically connectable to a power supply of the inhalation component generation device;

a sensor configured to acquire a value of a voltage difference between the two terminals or of a current flowing into and from the two terminals, the value related to an electrical resistance value of a resistor provided in the power supply, and to output the value as an output value; and

circuitry configured to determine, based on the output value, whether to change a predetermined control with respect to the power supply connected to the interface or whether to perform the predetermined control, wherein the predetermined control is a control for charging a secondary battery provided in the power supply and changing the predetermined control includes changing a rate for charging the secondary battery through the two terminals to be a rate determined according to a type of the power supply, the type determined according to the output value.

2. The external unit for an inhalation component generation device according to claim **1**, wherein

the external unit is a charger.

3. The external unit for an inhalation component generation device according to claim **2**, wherein

the circuitry is configured:

not to charge the power supply when the output value is outside a predetermined range or does not satisfy a predetermined condition; or

to output an abnormal signal when the output value is outside the predetermined range or does not satisfy the predetermined condition, and the circuitry is configured:

to charge the power supply when the output value is within the predetermined range or does not satisfy the predetermined condition; or

not to output the abnormal signal when the output value is within the predetermined range or satisfies the predetermined condition.

4. The external unit for an inhalation component generation device according to claim **1**, herein the circuitry is configured to:

detect connection of the power supply to the interface; and

determine whether to change the predetermined control or whether to perform the predetermined control, based on the output value output after the connection of the power supply is detected.

5. An inhalation component generation system, comprising:

a power supply of an inhalation component generating device; and

a charger comprising

an interface including two terminals that are configured to be electrically connectable to the power supply;

a sensor configured to acquire a value of a voltage difference between the two terminals or of a current flowing into and from the two terminals, the value related to an electrical resistance value of a resistor provided in the power supply, and to output the value as an output value; and

first control circuitry configured to determine, based on the output value, whether to change a predetermined control with respect to the power supply connected to the interface or whether to perform the predetermined control, wherein the predetermined control is a control for charging a secondary battery provided in the power supply and changing the predetermined control includes changing a rate for charging the secondary battery through the two terminals to be a rate determined according to a type of the power supply, the type determined according to the output value.

6. The inhalation component generation system according to claim **5**, wherein

an electrical resistance value of the resistor is constant irrespective of a state of the power supply.

7. The inhalation component generation system according to claim **5**, wherein

the resistor has a known electrical resistance value.

8. The inhalation component generation system according to claim **5**, wherein the power supply includes:

the power supply includes second control circuitry configured to perform control between a first mode in which the interface is electrically disconnected from the power supply or the second control circuitry and a second mode in which the interface is electrically connected to the power supply or the second control circuitry; and

the first control circuitry is configured to determine whether to change the predetermined control or whether to perform the predetermined control, based on the output value acquired during the first mode.

9. The inhalation component generation system according to claim **5**, wherein

the power supply includes second control circuitry configured to perform control between a first mode in which the interface is electrically disconnected from the power supply or the second control circuitry and a second mode in which the interface is electrically connected to the power supply or the second control circuitry; and

the first control circuitry is configured to determine whether to change the predetermined control or whether to perform the predetermined control, based on the output value acquired during the first mode.

10. The inhalation component generation system according to claim **9**, wherein

the second control circuitry is configured to transition the power supply from the first mode to the second mode after an elapse of a predetermined time period since detection of the connection of the charger.

11. The inhalation component generation system according to claim **10**, wherein

the first control circuitry is configured to determine whether to change the predetermined control or whether to perform the predetermined control, based on the output value is output before the predetermined time period elapses since detection of the connection of the power supply or an electrical resistance value of the resistor that is acquired by the sensor before the predetermined time period elapses since detection of the connection of the power supply.

12. The inhalation component generation system according to claim **10**, wherein

the predetermined time period is equal to or longer than a time period required from when the first control circuitry detects the connection of the power supply until the first control circuitry acquires the electrical resistance value of the resistor.

13. The inhalation component generation system according to claim **10**, further comprising:

a user interface, wherein

the first control circuitry or the second control circuitry is configured to cause the user interface to function in at least partial time period of the predetermined time period.

14. The inhalation component generation system according to claim **10**, further comprising:

a user interface, wherein

the first control circuitry or the second control circuitry is configured to cause the user interface to function in manners different after the elapse of the predetermined time period and within the predetermined time period, or cause the user interface to function only one of after the elapse of the predetermined time period and for the predetermined time period.

15. The inhalation component generation system according to claim **9**, wherein

a control cycle of the first control circuitry is shorter than a control cycle of the second control circuitry.

16. An inhalation component generation system, comprising:

a plurality of power supplies; and

a charger comprising

an interface including two terminals configured to be electrically connectable to the power supply;

a sensor configured to acquire a value of a voltage difference between the two terminals or of a current flowing into and from the two terminals, the value related to an electrical resistance value of a resistor provided in each of the plurality of power supplies, and to output the value as an output value; and

first control circuitry configured to determine, based on the output value, whether to change a predetermined control with respect to the power supply connected to the interface or whether to perform the predetermined control, wherein

the predetermined control is a control for charging a secondary battery provided in the power supply and changing the predetermined control includes changing a rate for charging the secondary battery through the two terminals to be a rate determined according to a type of the power supply, the type determined according to the output value,

the sensor is configured to output an output value related to an electrical resistance value of the resistor provided in each of the power supplies,

the resistor of each of the plurality of power supplies is connected in parallel with respect to the interface,

each of the plurality of power supplies include a switch configured to electrically connect and disconnect the power supply to/from the charger and is configured to be closed while the predetermined control is performed, and

the electrical resistance value of the resistor in each of the plurality of the power supplies becomes higher as the power supply is chargeable at a higher rate.

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